Chemical Age

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17 January 1959

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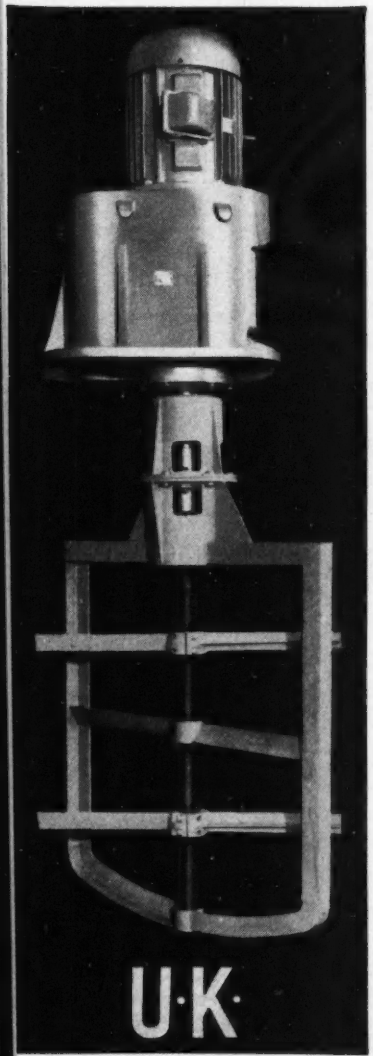

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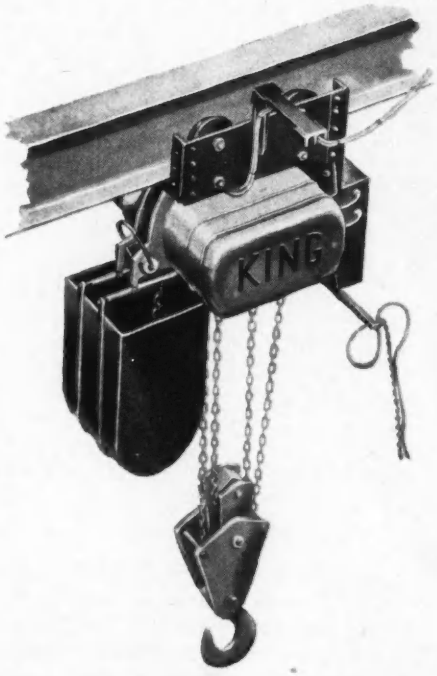

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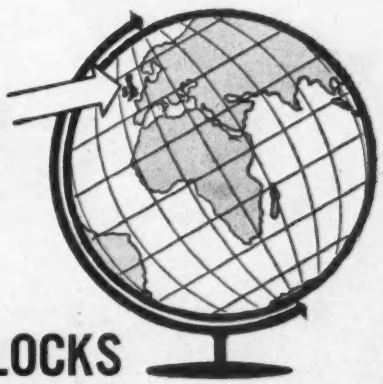

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Cartridges and Candles

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- **for casting high grade solid electrical insulations**
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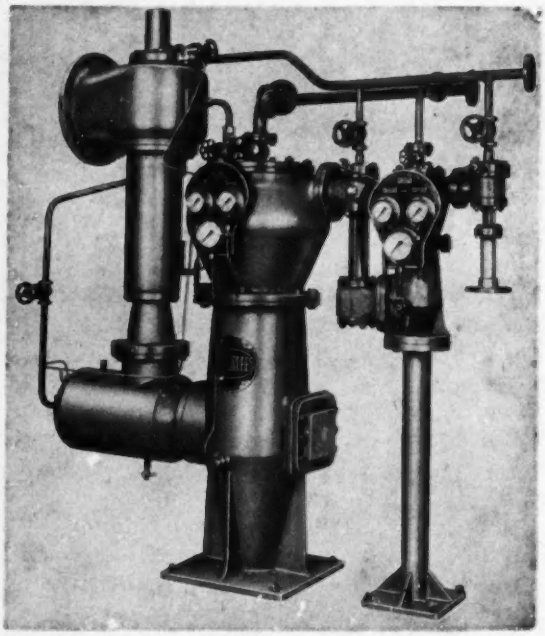

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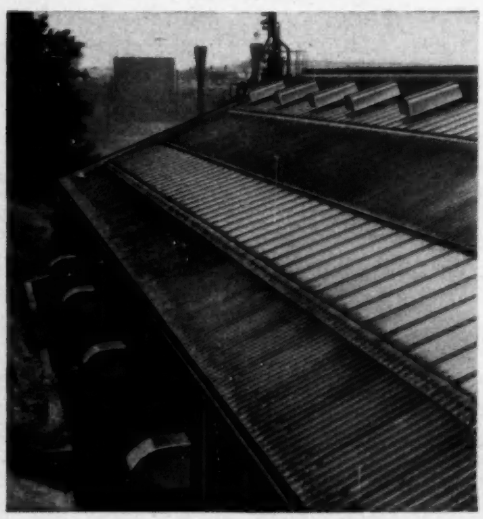

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CHEMICAL AGE

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HARD GOING FOR U.S.

SALES, earnings and operations of the U.S. chemical industry in 1958 suffered from the 1957-58 recession. With regard to the outlook for 1959 the industry, in certain sections at least, is uncertain although in general the situation shows a sharp contrast to that of 12 months ago. All in all, although the indicators point upwards, 1959 will not be a year of all-out prosperity for the U.S. industry.

The steep decline in sales, production output and inventories, last year, proved to be shorter lived than was then anticipated and after the first quarter, the industry showed signs of recovering. It is suggested that the year's sales should total about $23.1 billion compared with $23.4 billion for 1957 (*Chem. and Engng. News*, 1959, **37**, No. 1, 22) and a recent survey is stated to indicate that sales during the coming year will be about $24.5 billion. At the same time some in the industry have fears of inflation, greater competition and new cost increases.

U.S. labour problems were featured prominently early in 1958, but according to November figures the total employees in the chemical and allied products industries numbered 822,000 as against 838,00, and production personnel totalled 515,000 compared with 534,000. Few U.S. companies laid off professional and technical personnel, it is reported.

Whereas capital spending was considerably reduced last year, and some new plant projects were set aside, this year it is expected that capital expenditure will increase over 1958's second half rate. Initially this year it is expected that chemical constructors and equipment suppliers will find it hard going.

Examining the various sections of U.S. chemical industry in the light of the U.K. chemical industry, growing capacities and over-capacities are noted. Inorganic chemical production fell as it did in the U.K. Hydrochloric acid was down 13% as against the 0.9% increase in 1957. Chlorine, which was noted as having an annual capacity of 4.2 million tons was 12.2% down. Sodium hydroxide, annual capacity of 4.2 million tons, was down by 10.6%; nitric acid, annual capacity 6.1 million tons, was down by 7.5%; sulphuric acid, annual capacity 20.4 million tons was 6.2% down; and ammonia, with a 4.8 million tons annual capacity was up 3%.

In the fertiliser field use of ammonia is being expanded, *Chem. and Engng. News* reports, particularly in Western States. Helping this expansion along is off-season selling at well below usual prices (at $63 per ton). Urea output has kept in line with expanding capacity and it is expected that capacity this year will exceed 750,000 tons. Urea, however, is one item that is not in serious over-supply because of its other major outlets, e.g. plastics, coatings, adhesives, etc.

Ethylene oxide potential is given at 15,000 m. pounds a year and more is expected. A major outlet for this chemical, in ethylene glycol product, is down. Formaldehyde production increased last year and is expected to be about 14,000 m. pounds. A 5% increase is expected this year. Capacity, however, now totals 24,000 m. pounds. Like ammonia, states *Chem. and Engng. News*, urea is five years ahead of its outlets. Serious over-capacity faces phthalic anhydride particularly with new plants and expansion

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plans. At least one manufacturer has announced plans to sell this chemical at 17 cents, a price well below the current U.S. price.

The reason for the poor results in 1958 were the depressed U.S. motor industry and the consequent drop in paint usage and sales. Another chemical to be affected by paint sales has been pentaerythritol. Although sales increased in the second half of last year, this product is faced with serious over-capacity because of recent expansions. Present capacity is 130 million lb. but production is only about 52 million lb.

With the exception of the polyolefins, U.S. plastics showed no change in the growth rate. Vinyl polymers output has not only fallen but is facing over-capacity. By contrast polythene output will reach the '000 m. lb. level. Again, capacity is 13,000 m. lb., a 30% over-capacity. As CHEMICAL AGE has stressed previous (see CHEMICAL AGE, 20 December 1958, p. 1021) there is over-capacity in Ziegler- and Phillips-type polythenes and new outlets are required. The U.S. producers are now concerned about overseas markets especially for conventional polythene, which have been taking nearly a third of U.S. sales of this product.

In the polypropylene field, Hercules Powder, now making this polymer in limited commercial amounts, are expected to expand production, and the other companies interested in this product, Standard Oil's Humble, Enjay, and Eastman and others, are constructing plants. (CHEMICAL AGE, 20 December 1958, p. 1021, 13 December 1958, p. 980.)

This year the U.S. plastics industry awaits the finding in the Du Pont-Phillips polythene patent suit. Also there is now speculation as to whether Montecatini will take their polypropylene claims to court (CHEMICAL AGE, 13 December 1958, p. 980 and 27 December 1958, p. 1052.)

Competition in synthetic fibres is also expected to grow fiercer in the U.S. Competing with Du Pont's Dacron, polyethylene terephthalate (Terylene), will be I.C.I.'s. Terylene to be produced and marketed by an I.C.I.-Celanese Corporation company, Fiber Industries Inc., under the trade name Teron. Fiber Industries are building the manufacturing plant near Shelby, North Carolina. Du Pont are also expanding their Dacron facilities with a new 56 million lb. plant in Tennessee, thereby more than doubling their present capacity of 45 million lb.

In the nylon field, U.S. producers, Allied Chemical's National Aniline Division, Spencer Industrial Rayon's Ohio River and Commercial Solvents, are reported as proceeding with expansion plans for caprolactam (*Chem. and Engng. News* (see above and CHEMICAL AGE, 29 November 1958, p. 894). Over-capacity will be unavoidable.

A surprising and unexpecting finding last year was the increased demand for acetate fibre, which is expected to continue. This is due to its usage in cigarette filters.

Despite the better business and rising sales at the year end, prices by contrast have fallen. In fact, because of falling prices, buyers are holding off buying, particularly in the case of sulphuric acid. Soda ash and sodium hydroxide sales and 1959 contracts for these have not been affected.

Profit margins last year dropped at least 4%, but faced with the recession, U.S. companies subjected operating costs to scrutiny. The chemical industry will have to continue keeping costs down, and will have to cope with considerable over-capacity. On the brighter side, capital expenditure will be less and should demand rise, it will be possible for production to be geared-up without additional expense.

Last year this journal indicated that 1958 would see more mergers among U.S. companies. The past year has confirmed this belief. Not only have U.S. pharmaceutical and chemical houses merged with one another, but with companies with diversified interests. Also, several joint ventures have been noted, especially in the rapidly developing rocket fuel field. Also confirmed was the suggestion that U.S. companies would seek further tie-ups with U.K. and Continental companies, as for example, Vick Chemical's acquisition of Milton Antiseptic, and Denver Manufacturing's taking-over the Deosan factory, the I.C.I.-Celanese Corporation joint venture Fiber Industries, and Dow Badische, formed by Dow Chemical and Badische Anilin- und Soda-Fabrik of Germany.

In the Netherlands, American Cyanamid have set up a new company, Cyanamid-Ketjen N.V. with Ketjen (Amsterdam) N.V. to produce catalysts. This latter company has also started Ketjen-Carbon N.V. with Godfrey Cabot Inc., to produce carbon black, and B.F. Goodrich have formed a joint company with Algemene Kunstzijde Unie N.V. (A.K.U.) to make several types of synthetic rubber. France and Italy now seem to be following suit and this year more U.S. tie-ups with chemical concerns in these countries seem likely. In this way the U.S. chemical companies will try to solve the threat of the Common Market to their exports.

CHARCOAL ABSORPTION COMEBACK

CHARCOAL absorption plants used during the early years of the natural petroleum gas industry which were discarded for the less bulky, more efficient oil absorption and refrigeration plants, now appear in somewhat different form to be making a comeback. Four U.S. companies Delta Tank and Mfg., National Tank, Jefferson Lake Sulphur, and Parkersburg Rig and Reel (*Chem. Engng.*, 1958, **65,** No. 25, 72) have absorption-based package units. The units also dehydrate.

With improved adsorbents, smaller equipment and shorter process cycles the units can cope with a hitherto neglected section—namely, the 10,000 million cu. ft./day of gas from streams previously deemed too small or too poor to justify oil absorption or refrigeration. Most suitable are streams of between 10 and 40 million cu. ft./day having a new gasoline content of between 0.1 and 0.3 gall./1,000 cu. ft. (gall./M. cu. ft.) of gas.

To regenerate the adsorbent material high-temperature (600°F) natural gas is used, as compared with 350-400°F steam used for the old-style charcoal beds. Being relatively small beds of activated material, the new-style units heat quickly and uniformly to regenerate-temperature, and cool rapidly down to absorption temperature, so permitting a fairly long operating life for the adsorbent (about one year).

Closed-cycle regeneration is stated to improve markedly efficiency of hydrocarbon recovery, and to prevent loss of a certain amount of recovered product by feedback. While costing more, the increases gained using the closed-cycle system are stated to more than offset the added expense, except when the gas contains less than 0.1 gall./M. cu. ft. The ability of the unit to condense hydrocarbons stripped from the adsorbent during regeneration is important.

The Parkersburg unit is designed to recover only pentanes plus. All the others can recover liquefied petroleum gas (LPG) as well. Delta installations (Dryex units) extract, it is claimed, 60 to 90% of the pentanes—plus fraction and condense 95% of the material extracted. The adsorption towers 10 or 15 ft. high by 36 or 48 in. are fitted with silica gel and can handle gas flows of 6 to 35 million cu. ft./day. With product content in the feed stream varying from 0.098 to 0.313 gall./M. cu. ft. recovery ranges from 19 to 93 barrels a day. The Dryex assembly includes heat exchangers, an extracted-liquid accumulator vessel, a gas pump and motor, and a direct-fired regeneration-gas heater. Cost of the unit complete ranges from $1,000 to $1,600 daily barrels of petroleum at recovery rates of 40 to 200 barrels a day. Direct operating costs are calculated at 15 cents or less per barrel of recovered product. It is expected that larger installations will be required with most interest centred on the two-product units for LPG and raw petroleum.

SYMPOSIUM ON NEWER POLYMERS

At the S.C.I. symposium on polymers last week are l. to r.: M. N. Berger (Petrochemicals Ltd.), R. Hayes (British Resin Products Ltd.); Dr. J. N. Milne (Du Pont (U.K.) Ltd.); T. H. Boultbee (Petrochemicals); C. E. Hollis, chairman S.C.I. Plastics and Polymers Group; Professor G. Gee, chairman, S.C.I., Manchester section; and Dr. M. G. T. Burrows, hon. secretary, S.C.I., Manchester section, who is with Murgatroyd's Salt and Chemical Co. Ltd.

Four Papers Presented at Joint S.C.I.—R.I.C. Meeting

SYMPOSIUM on 'Some newer polymers—their structure and uses,' held last week by the Plastics and Polymer Group of the Society of Chemical Industry and the Royal Institute of Chemistry, attracted a large audience. The symposuim was held in the chemistry lecture theatre of Manchester University on 7 January.

Professor Geoffrey Gee, Sir Samuel Hall professor of physical chemistry, Manchester University, was chairman at the first session and Mr. C. E. Hollis, the Distillers Company Ltd., Great Burgh, was chairman at the second session. Professor Gee is chairman of the S.C.I. Manchester Section and Mr. Hollis is chairman of the Plastics and Polymer Group.

Papers were read by Mr. R. Hayes (British Resin Products) who spoke on 'The structure and properties of Rigidex polyethylene,' Mr. M. N. Berger and Mr. T. H. Boultbee (Petrochemicals Ltd.) on 'Ziegler polyethylene,' Professor Gee on 'Polyethers,' Dr. J. Milne (Du Pont (U.K.) Ltd., on 'Some speciality elastomers—their properties and uses (neoprene, Hypalon, Viton).'

Mr. Hayes on Rigidex

Discussing 'Properties and applications of Rigidex polyethylene', Mr. R. Hayes (British Resin Products Ltd.), related some of the properties of polythene as produced by the Phillips method using a metal oxide catalyst, such as the oxides of iron cobalt or nickel.

These polythenes have a predominantly linear structure and are highly crystalline and generally have a higher density than conventional polythene made by the high pressure method. The increase in density leads to an increase in rigidity, softening temperature and tensile strength but a decrease in elongation and impact strength. The softening point also becomes much sharper with higher densities. The effects on the softening point may raise a number of difficulties in moulding due to the high temperatures involved and the narrow range at which the polymer is rubber-like. Shrinkage may cause a problem in moulding and it is increased by higher densities.

The high density greatly reduces the effect of swelling by solvents and by reason of the close packing greatly reduces the permeability of the material. For example, permeability to gases is reduced to one-quarter of that of conventional polythene; reduction of the permeability to liquors is even greater.

The increase in molecular weight gives a rise in the melt index which is corrolated with the extrusion properties of the polymer. Higher molecular weight also produces greater impact strength and resistance to stress cracking. Controlled cross-linking has been carried out to increase the polymer's molecular weight thus obtaining the benefits of high molecular weight without losing many of the high density properties.

Many patents for catalytic systems producing polythenes of different molecular weights with high density, have already been taken out. New developments include the introduction of controlled branching by means of copolymerisation, emphasis being placed on the control of the length of the branch. By controlling the branching the balance between flexibility and rigidity can be controlled.

New Developments in the Ziegler Process Outlined by Petrochemicals Workers

NEW developments of the Ziegler process had led to the formation of high-density polymers, and in this respect nearly every combination of, metal, metal hydride and organometallic compounds of Group IV metals as reducing agents and compounds of metals of sub-Groups IVA-VIIIA as transition components, has been used and also many have been patented. This was stated by M. N. Berger and T. H. Boultbee (Petrochemicals Ltd.) in their paper on 'Ziegler Polyethylene'.

All combinations are not equally effective and combinations of alkyl aluminium and titanium chlorides are the most widely used.

The Ziegler development has covered a wide range of research including the effect of different catalytic systems, productions of copolymers—different-reaction media, all leading to control of molecular-weight in order to produce high-density polymers with differing qualities of flexibility, impact strength and other associated properties. Much attention has been paid to the purity of the solvent and reaction media, so that unwanted side branching will not occur.

Exploration into the reactivation of catalysts has been carried out and in this respect the smaller the alkyl radical the greater the rate of reactivation.

Removal of the catalyst and catalyst residues from the polymer is important as it is thought that various properties of the polythene may be affected by them. For example the higher dielectric loss of Ziegler material as compared with other polythenes may be due to these residues.

The use of filters and antioxidants to prevent degradation of polythene is another aspect of Ziegler development. Where colour is unimportant carbon black gives the best results, due to the fact that it absorbs light (which has an effect on degradation) and also forms a bond with the polythene.

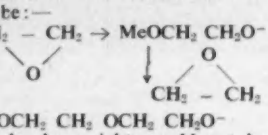
Phenolic antioxidants are often used but it is important to remove the Ziegler catalyst residues, otherwise staining may occur. Oven-ageing experiments suggest

that with the use of antioxidants or stabilisers long service life can be attained.

The use of irradiation to promote controlled cross-linking and subsequent increase in molecular weight had been tried. This increase in molecular weight increased resistance to stress-cracking and increased impact strength—important factors to consider in the design of pipe work.

Prof. Gee on Polymerisation of Olefin Oxides with Basal Catalyst

PROFESSOR G. GEE, who spoke on 'Polyethers' discussed the polymerisation of olefin oxides using a basal catalyst. The main work was done on ethylene oxide using a sodium methylalcohol catalyst. Other alcohols proved to be unsuitable. The reaction was assumed to be:—



$$MeO^- CH_2 - CH_2 \rightarrow MeOCH_2 CH_2O^-$$

$$MeOCH_2 CH_2 OCH_2 CH_2O^-$$

High molecular weights could not be attained due mainly to proton transfer which would bring about termination and limit the size of the chains. The proton transfer was due to the presence of free alcohol thus

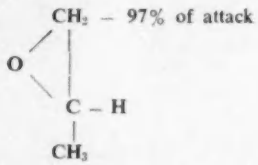
$$MeOCH_2 CH_2 OCH_2 CHO^- + MeOH \rightleftharpoons MeO^- + MeOCH_2 CH_2 OCH_2 CHOH$$

(short chain polymer).

This was even more pronounced with higher alcohols.

It was found that for molecular weights between 150-1,000 the rate of polymerisation was proportional to the amount of catalyst and ethyl oxide. Variations from this rule using alcohols other than MeOH were found to be due to incomplete ionisation.

Experiments on other olefin oxides showed that with basal catalysts the attack was centred upon the carbon atom bearing the two hydrogen atoms; for example, with propylene, 97% of the attack was at this atom.



Any attack on the carbon atom bearing the alkyl radical was very slow, if it occurred at all. These polythenes were water-soluble even at high molecular weights.

It could be seen that in general this method for basal catalysts of olefin oxides was impractical especially for olefins above propylene.

Properties and Uses of Speciality Elastomers, by Dr. J. Milne

THE last address was by Dr. J. Milne (Du Pont (U.K.) Ltd.) who spoke on 'Some speciality elastomers—their properties and uses'. The lecture was concerned with the development of neoprene, Hypalon and Viton for special purposes.

New methods of producing neoprene from acetylene were being used and this had led to the production of neoprenes (W neoprenes) not containing labile sulphur which would attack rubber. These W types of neoprene could be co-masticated with rubber to improve its natural resistance to temperature, oil and other environmental stresses. With W neoprene more filler could be added to increase the hardness without having too detrimental effect on the tensile strength. Neoprenes (WB) with a somewhat lower tensile strength and elongation properties than type W could be manufactured where these properties were not so essential and more hardness was required.

A liquid neoprene (type F.B.) had been widely used as a plasticiser for a variety of elastomers and rubber compounds. It was often used as a copolymer with other neoprenes as it plasticised them without affecting their specific properties.

Although differing quantities of chlorination and sulphonation could be obtained for specific Hypalons, the most satisfactory proportions were 1 chlorine to 7 carbon atoms and 1 sulphonyl to 9 carbon atoms.

Hypalon had a wide variety of uses, especially by compounding with rubber materials of various kinds, for example, car tops, camera bellows, hoses, etc., and it was widely used for surface films giving better protection, better appearance and easier cleaning due to oil resistance.

Hypalon 30 was often used for emulsion paints. Coating properties and more durable higher gloss were better than other Hypalon but the oil and low temperature resistance was not so good.

Viton's most spectacular property was its resistance to high temperature and it was in this field that it had found most use. It could withstand long exposures to 600°F in dry air and also long exposure to oils and other solvents at 400°F.

One advantage of Viton was that it could be used on conventional rubber manufacturing plants. Its high temperature properties opened up a wide field of uses, for example, seals for gas pumps, fire walls, hot air ducts and hoses for carrying high temperature liquids. It could be used in epoxy resins for joining ceramics for use at high temperature.

There are some difficulties in curing Viton, i.e. side chains and cross-linkage might occur giving rubber-like properties. High energy radiation and peroxide were used for curing. No successful plasticiser had been found and care had to be taken to select fillers in relationship to the environment.

The high cost of Viton—£6 per lb.—had so far more or less confined its use to military purposes.

Pure Chemicals Organotin Stabilisers

SINCE 1950, Pure Chemicals Ltd., Kirkby Industrial Estate, near Liverpool, have marketed their Stanclere range of organotin stabilisers. The company have introduced a technical bibliography on organotin compounds.

In the field of organotin compounds as catalysts, Pure Chemicals can offer tetra-n-butyltin, tetra-n-propyltin, tetra-n-octyltin and tetraphenyltin for research and development work on catalytic processes.

Organotin compounds have established themselves in the paper industries where they are used to control shine as well as imparting mould resistant properties to the paper. From information available to Pure Chemicals it would seem that the use of these compounds together with certain selected slimicides already on the market can lead to economies of up to 25% in shine control costs. The company state that newer, more efficient organotin compounds for this purpose are being developed.

It is believed that the fungicidal properties of the organotin compounds will find an outlet in agriculture and horticulture. The triphenyltin compounds have been found to possess excellent activity against certain moulds and at the same time to be non-phytotoxic at the concentrations employed. Used for control of leaf spot in sugar beet and celery, results in increased yields of as much as 80 to 100%. Production of triphenyltin acetate is now being developed by the company, and inquiries from anyone interested in this field are welcomed.

Among miscellaneous uses suggested for organotin compounds is the use of dibutyltin dilaurate as an anthelmintic in poultry.

A. & W. Extend Kanigen Facilities

BECAUSE of a substantial increase in the U.K. demand for Kanigen plated components, especially in the chemical engineering and aircraft and mechanical industries, Albright and Wilson (Mfg.) Ltd., the sole U.K. Kanigen licensees, have installed two additional plating tanks in their Kanigen plating plant at Oldbury, Birmingham.

In order that a greater range of components can be handled speedily, the new tanks now brought into commission are respectively, 6 ft. in depth and 2 ft. in diameter, and 3 ft. in depth, 4 ft. long and 2 ft. wide.

Kanigen chemical nickel plate is a nickel-phosphorus alloy containing about 8% phosphorus. It has extremely low porosity and is hard (1,000 V.P.N. after heat treatment) and corrosion and wear-resistant. On ferrous materials the plate prevents contamination of liquids by iron from pumps, pipework and containers. Expensive alloys can often be replaced by Kanigen-plated steel or aluminium. The plating solution deposits a continuous and completely uniform plate on the most complex components.

HYDRO-REFINING OF CRUDE BENZOLES

Meeting Europe's Need for High Purity Benzole

REMOVAL of undesirable compounds from complex organic liquid mixtures by catalytic hydrogenation has been practised for a considerable time by the petroleum industry. Continental benzole refiners are also in favour of this technique and are abandoning the conventional acid washing process. The large scale pilot plant at the Thorncliffe works of Newton Chambers and Co. Ltd., has allowed considerable experience to be gained in application of the hydro-refining technique to British benzoles. 'Typical' benzoles have been obtained with sulphur contents as low as 0.4% and as high as 2.4% w/w. This field of hydro-refining of crude benzoles has been described by R. Middleton and D. Bradley, A.R.I.C., of Newton Chambers and Co. Ltd., (in a paper in *The Gas World—Coking*, 1958, 3 January, p. 5).

Extensive research carried out by the Coal Tar Research Association into catalysts and reaction conditions, has resulted in the selection of a catalyst showing a satisfactory degree of activity and which, moreover, is selective in promoting the hydrogenation of the impurities contained in crude benzole leaving the aromatic nuclei practically unchanged. The large scale pilot plant built by Newton Chambers following the successful laboratory scale unit was built to handle benzoles or naphthas at the rate of 20 galls./hr. The plant was also designed to work at pressures up to 1,000 p.s.i.g. It has thus been possible for Newton Chambers to examine the problems encountered on large-scale operations and to collect chemical engineering data.

Pilot Plant Studies

The Pilot Plant. Fresh gas is introduced to the plant by the compressor to enrich the recycle gas. The ratio of fresh to recycle gas is maintained so that the mixture has the optimum hydrogen concentration for the particular feedstock. The temperature of the process gas is raised in the gas-fired heater before entering the evaporator. The benzole fraction to be treated is passed through a heat-exchanger before entering the evaporator, where it is vaporised into the process gas stream. Heavy residue is withdrawn from the base of the evaporator. The benzole/gas mixture is then heated in the second gas-fired heater before passing to the catalyst vessel—the converter. In this vessel, which is of tubular construction, the heat of reaction generated in the catalyst mass is used to raise the benzole/gas stream to the final reaction temperature and in this way effective control of the process is achieved.

From the converter, the reaction gases then pass into the evaporator, thereby providing the heat required to evaporate the benzole. The products of the reaction are finally used to preheat the benzole liquid entering the system, and are then cooled and condensed. The resultant liquid, after decompression, is washed with caustic soda solution and finally with water to remove the hydrogen sulphide remaining in solution.

From the condenser, the gas is split into two streams, the larger portion being returned to the process enriched with fresh gas to maintain correct hydrogen concentration. The remainder, the purge gas, is removed from the process, where it can be used to fire the heaters. On a coke oven plant or gas works installation, the purge gas can be returned to the foul gas main and other fuels, i.e. pitch/creosote used on the fired heaters.

Pressures Employed

Pressures of the order of 450 p.s.i. and a temperature in the range 380° to 420° C are usually employed. Gas consumption for a crude benzole with a sulphur content of 0.5% and a bromine no. of 10, consumes between 5 and 8 cu. ft. of coal gas per gallon of benzole. If all the purge gas were returned to the foul main for purification together with the normal crude gas, then on a thermal basis this figure would be reduced to 3 to 5 cu. ft. per gallon. The normal discard gas when cooled to 25% or less has a benzole content of approximately 0.5 gall./10,000 cu. ft.

The benzole after decompression, and now at atmospheric pressure and temperatures, is saturated with hydrogen sulphide. Caustic soda washing would remove H_2S but would give rise to an aqueous effluent. On an ammonia plant this could be disposed of, but it has been found that a 'degassing' column is a more economical method of disposal of H_2S. In the column which contains only a few plates, all the H_2S is driven off along with the low boiling C_2 and C_3 hydrocarbons, but C_5 and higher paraffins are not significantly affected. Cost of H_2S removal using this method is about 350 B.Th.U. per gallon, or 0.02d. per gallon. The caustic soda method may cost as much as 5d. per gallon. The gaseous effluent from the 'degassing' has a high concentration of H_2S, and is rich in C_2, C_3 paraffins which have a high C.V., and is free from organic sulphur. It is emphasised that removal of H_2S must be carried out immediately after hydro-refining to prevent the oxidation of sulphur compounds to free sulphur.

Results obtained from the pilot plants of C.T.R.A. at Gomersal and that at Thorncliffe are reported as having been 'extremely good'. Total sulphur contents of 0.01% w/w on fractions boiling at 160° to 170° C are stated to be readily obtained with a bromine number of less than 0.5. Sulphur (as thiophene) of the benzole fraction is almost indeterminable, i.e. it is of the order of 1 p.p.m. or less. It is claimed that it is therefore possible to reduce the total sulphur of the benzene fraction to less than 10 p.p.m.

Benzene of the above purity is of particular importance to the synthetic chemical industry and cumene production. The toluene and xylene associated with benzene of such purities have similar qualities. Both have bromine numbers below 0.05, while the total sulphur contents are of the order of 0.01% w/w for toluene and 0.05% w/w for xylole. These qualities can be obtained by hydro-refining with a yield greater than 99% and disposal and treatment of acid tar is avoided.

Increasing Demands

Middleton and Bradley state that the benzole industry should prepare itself for increasing demands for benzole of the highest grades of purity. They quote Bronowski's statement that by 1975 there will be a deficit between demand and production of 640 by 10^6 lb. per annum, while there will be a surplus of toluene of 81 by 10^6 lb. per annum. A fair proportion of the benzole deficit can be met by the petroleum industry and also indirectly from the gas industry from the new high-pressure oil gasification techniques. With the possibility of the Free Trade Area, more stringent specifications for pure benzole would be required, for on the Continent the crystalling point required is much higher.

Application of Distillation Techniques. Generally, fractionation of hydro-refined benzoles is more difficult than acid-washed benzoles. Due regard must be taken also of original paraffin content of the crude material, in addition to that formed as a result of changes which take place over the catalyst during hydrogenation. In examination of this aspect, the application of gas chromatography techniques has proved of great value in following the course of secondary reactions.

Cyclohexane content has to be kept as low as possible since it forms an azeotrope with benzene (b. pt. 7.4° C /%/w/w benzene 49.7). Other compounds which interfere markedly with the fractionation of benzene are 2.4 dimethyl pentane, which also forms an azeotrope with benzene and *n*-heptane and methyl cyclohexane. The last two are removed as intermediates and have to be reduced to about 0.25% of the benzene produced to ensure a crystallising point of 5.3° C. Benzene of crystallising point greater than 5.3° C can be obtained in substantial yield by reasonably straight forward distillation.

The solution to the problem lies in the

INDIA TO SET UP FIRST

present used in the hydrogenated oil

prevention of the hydrogenation of aromatics leading to the production of these interfering hydrocarbons. Production of cyclohexane and methyl cyclohexane can be minimised by hydro-refining at low hydrogen partial pressures, although these must be high enough to ensure adequate desulphurisation. The main source of difficulty in the subsequent benzene distillation can be avoided by removing all toluene from the benzene before hydro-refining. This action has also been found to produce substantial reductions in both operating and capital costs of the distillation plants.

Toluene and Xylole Production. With a fairly high gravity source, 85 to 95% of the available toluene can be recovered as toluene passing N.B.A. No. 7A specification with a heat consumption of the order of 9 to 10,000 B.Th.U. per gall. of toluene. At least 75% of xylole present in the same feedstock can be recovered as 2° xylole with a specific gravity greater than 0.865.

TABLE I

Comparative Costs of Hydro-refining and Acid Washing

	Hydro-refining	*Acid washing*
Capital cost	£150,000	£60,000
Operating costs ...	d./gall.	d./gall.
Labour	0.16	0.16
Gas:		
Reaction	0.10	—
Heating	0.11	—
Power:		
Compressors ...	0.20	—
Other	0.13	0.05
Water	0.02	0.01
Catalyst	0.06	—
Other stores	0.03	0.03
Repairs and renewals	0.16	0.26
Supervision	0.41	0.41
Fixed charges ...	0.86	0.35
Reagents	—	0.75
Steam	—	0.30
	2.24d./gall.	2.32d./gall.

Prod. val. = 40½d./gall. crude. 38d./gall. crude.
Extra profit per year = £47,000.
Extra capital paid off in 1.9 years.

Crude benzenes can be sub-divided into three categories according to the treatment which they must receive to yield pure products. The first of these is obtained from coke ovens operating with lower top temperatures, and have considerable quantity of paraffins and naphthalenes. If benzene of crystallising point 5.2° to 5.3°C is required, the only distillation possible is that of superfractionation employing extremely large platages and uneconomical heat requirements.

The second group of benzoles contains a small quantity of interfering saturates. The economical method of hydro-refining these is by employing fractionation before and after hydro-refining.

The third group includes the paraffin-free benzoles which give little interference with fractional distillation after hydro-refining. Coke oven construction and operation is stated to be moving to ward production of this type of product.

Advantages of Hydro-refining. The main difference between acid washing and hydro-refining is that there is no loss of unsaturateds and aromatics in the removal of sulphur compounds by hydro-refining. The increased yield varies with different benzoles but with a saving of 5 by 10% or even greater the hydro-refining process is attractive. It is realised that some of the hydro-refined products are saturated and hence of lower value, but sulphonation of aromatics takes place to a much greater extent when acid-washing is used, than does hydrogenation of aromatics during hydro-refining. An increased yield of xylole is obtained, and at the present price this again is attractive and offsets to a large extent the lower price of the paraffins. Toluene recovery is also increased, while the benzene recovery is about the same as with acid-washing. Reagent costs have been found to be much less when hydro-refining is undertaken. Gas, the only raw material used in the refining stage, costs a little over 0.1d. per gall. crude benzole, while acid and caustic soda costs can amount to 0.75d. per gall.

With regard to the cost of steam, the benzoles which require prefractionation are subjected to two distillations, which is common to most acid washing techniques for the high qualities. Little more steam is consumed on the hydro-refined distillation scheme than there is on current acid washing procedures. No steam is consumed on the hydro-refining plant as there is no regeneration of acid. When no fractionation of the crude benzole before hydro-refining is necessary, a distillation step is completely removed.

Capital cost of the hydro-refining plant is greater than the cost of washers, acid recovery plant, etc. The profits from a hydro-refining plant are, however, greater than those from an acid washing plant, and these extra profits can be used to write off this capital difference in quite a short time.

Other advantages are the operation of a continuous plant which is cleaner and has no great quantity of aqueous effluent. There are no acid tar problems. There is, too, the fact that production of benzene by this combined technique, yields a product with a crystallising point of 53°C, which is an attractive commercial proposition from high gravity feedstocks.

Cryoscopic Technique

Application of Freezing. Middleton and Bradley, in their paper, then describe the use of hydro-refining followed by the application of another technique—the method of freezing. The possibility of crystallisation as a means of purification in order to produce benzene of a higher quality than that corresponding to a crystallising point of 5.3°C was investigated. It was also hoped that this method could be applied to vertical retort benzole. While not new, the freezing method had not been developed to the commercial stage for the production of high grade benzene from acid-washed benzoles. The thiophen contents must, however, be almost immeasurable. Since this can be accomplished by hydro-refining, without any serious reduction in the yield of product, the attractiveness of the cryoscopic process becomes obvious from a thermal consideration, it is seen that the heat required to extract benzene by crystallisation is less than that required for evaporation. The latent heat of fusion of benzene is 30.1 cals. per gramme, while the latent heat of evaporation is 90.4 cals. per gramme. Also, as most common refrigerants have a performance coefficient of approximately 5, the actual ratio of the two latent heats becomes 1 to 15. When the cost of steam at 100d. per 1,000 lb. is compared with that of electrical energy at 1.1d. per k.W.h. the ratio is then reduced to 1 to 6.

To obtain a yield of 95% of solid benzene from a high gravity crude feedstock requires a crystallising temperature in the range—70° to 80°C. Since the cost of refrigeration increases with the temperature reduction which is necessary for the process, it will be noted that the advantages referred to in the previous paragraph are adversely affected if straight forward crystallisation methods are adopted for high yields. It was considered that high operating costs could be overcome by a combination of simple distillation and refrigeration. One such process has been fully proved in the laboratory by C.T.R.A.

Crystallising Benzene

Hydro-refined feedstock, mixed with recycled supernatant liquor, is first treated in a defrosting column. Defrosted benzole is then heated in the upgrading column —the benzene fraction passing forward to the crystalliser and the residual toluene/xylole stream passing on to the conventional distillation units. A proportion of the benzene is solidified in the crystalliser and the resultant slurry is centrifuged. The benzene crystals, separated in this way, are then washed and discharged. The supernatant liquor from the centrifuging operation is returned and mixed with the feedstock prior to admission to the defrosting column. Using simple distillation columns in this way the paraffin content of the original feedstock is diverted into either the fronts fraction or the toluole/xylole fraction, from where it is easily removed, and the resultant feed to the crystalliser contains an equilibrium concentration of paraffins which does not interfere with the crystallisation process.

Results of combined cryoscopic/distillation. Some 'extraordinarily good results' are reported. Benzene has been obtained having a crystallising point of 5.51°C in yields of 95% of the amount of benzene available in the crude feedstock. The sulphur content of the crystals has been so low as to be undeterminable using current analytical methods. Capital and operating costs are stated to be commercially attractive. Also results obtained on low gravity benzoles of vertical retort origin have been equally encouraging. Because of these results, work on the cryoscopic technique as a means for commercial production of high grade benzene is proceeding at a fairly rapid pace.

Costs. The costs clearly indicate the considerable financial advantages of hydro-refining these authors state. In the case quoted in the table the extra capital cost could be paid off in a matter of two years, it is claimed. In the case of class 2 benzole, the time required to pay off the extra cost would be almost four years and in the case of class 1 benzole, employing the cryoscopic technique, it is estimated that the extra capital cost would be returned in two years.

INDIA TO SET UP FIRST SYNTHETIC RUBBER PLANT

Aid from Three U.S. Firms Expected

INDIA's first synthetic rubber plant, with a capacity of 20,000-30,000 tons of rubber per year, will be set up at Bareilly (U.P.). U.S. aid for the Rs 17 crore project is expected to be available through equity participation by a combine of three manufacturing firms, including Goodyear Co. Inc.

Consumption of industrial alcohol in the factory will be of the order of 12 million gall. a year, which will be met from indigenous production. Since 1947, there has been a 300% increase in the output of industrial alcohol in the country. The production in 1957 was 15.5 million gall. as against 3.76 million gall. in 1947. The target for 1960-61, i.e. by the end of the Second Plan period, has been fixed at 45 million gall. a year. This would make India one of the largest industrial and power alcohol producers in the world.

Pilot Plant Projects at the National Laboratories: At the recent meeting of the governing body of the Council of Scientific and Industrial Research at New Delhi it was decided to set up the following pilot plants in different national laboratories:

Coal tar hydrogenation plant—The 100 gall. per day plant to be set up at the Central Fuel Research Institute, Jealgora will be used for working out conditions for the low-temperature production of diesel oil by the hydrogenation of coal tar and lignite tar. The plant will also be utilised for research on hydrorefining of phenols.

Sodium Sulphate Project

Sodium Sulphate from Sambhar Lake Bitterns: The 14-ton capacity pilot plant (estimated cost, Rs 5.9 lakhs) to be set up at the Central Salt Research Institute, Bhavnagar, will be employed for working out conditions for the recovery of sodium sulphate and sodium carbonate from the bitterns left after the recovery of common salt from Sambhar Lake Rajasthan) brine. About 250,000 tons of these bitterns are available annually and these can yield about 15,000 tons of sodium sulphate, 8,000 tons of sodium carbonate and 40,000 tons of edible salt. The process worked out at the Institute from laboratory scale investigations involves the following steps: (i) elimination of algae (which impart a red colour to the salt) from the liquid bitterns or aqueous extracts of solid bitterns by chlorination; (ii) chilling to 0°C. and removal of the sodium sulphate crystals obtained by centrifugation; (iii) recovery of sodium chloride from the desulphated liquor by solar evaporation; and (iv) carbonisation of the desalted liquor and recovery of sodium carbonate as bicarbonate.

Manufacture of Dairy Salts: The pilot plant (capacity 5 cwt. per day; cost Rs 50,000) for the manufacture of high grade salt will also be used for producing B.P. and A.R. grades of sodium chloride at the Central Salt Research Institute, Bhavnagar.

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- New synthetic rubber factory will have a capacity of 20-30,000 tons a year
- A 100-gall. per day pilot plant is to be set up for coal tar dehydrogenation
- New research project to produce sodium sulphate from Sambhar Lake Bitterns
- National Institute for Petroleum Technology is proposed to be set up at Dhanbad.

Synthetic Oils for Leather Industry: The pilot plant to be set up at a cost of Rs 84,000 will be employed for standardising conditions for the large-scale chlorination and sulphochlorination of mineral oils. Laboratory scale experiments have indicated that satisfactory oils can be produced which can be effective substitutes for imported fish oils used at present in the processing of leathers. India imports about Rs 20 lakhs worth of fat liquors, resins and stuffing materials.

Refining of Cottonseed Oil: A simple method for the removal of colouring matters, particularly gossypol, from cottonseed oil recently developed by Prof. T. R. Seshadri, of the chemistry department, University of Delhi, has reached the pilot plant stage. This process has potentialities of revolutionising the cottonseed oil industry in India. A pilot plant (capacity per batch, 100-120 lb.) has now been set up at the Shri Ram Institute for Industrial Research, Delhi.

The process involves the addition of a 20% hot borax solution (containing 1% borax on the weight of oil) to cottonseed oil under constant stirring. The colouring matters in the oil form a complex with borax and settle down on allowing the oil to stand. The oil is then given the usual alkali wash.

At present, only 6% of the cottonseeds produced (1.7 million tons per year) in India are crushed for oil as compared to 75% in the U.S. Adoption of the new refining process is expected to help in the replacement of a major portion of the groundnut oil at present used in the hydrogenated oil industry.

New Rayon and Staple Fibre Factory: A new company, the South India Viscose Ltd., Coimbatore, was recently floated with a capital of Rs 3.5 crores for setting up plants for the manufacture of staple fibre and rayon. At present there are three factories in India manufacturing rayon yarn by the viscose process and their total production is about 25,740,000 lb. per year.

The new factory will have a capacity of 8,000,000 lb. viscose rayon yarn and an equal amount of viscose staple fibre per year. The factory will produce its entire requirements of sulphuric acid and carbon disulphide, but the cellulose (7,500 tons per annum) required will be imported. There is a programme, however, to produce, at a later stage, the required amount of cellulose from indigenous raw materials such as cotton linters, bamboo and wood from eucalyptus (*Eucalyptus globulus*). The Italian company, Italviscosa Eastern Trading Co. of Milan has agreed to supply the required machinery on a deferred payment basis and also to provide the necessary technical assistance in the setting up and running of the plants. The factory will start producing staple fibre early in 1959 and rayon yarn in 1960.

Ceramic Thermocouples

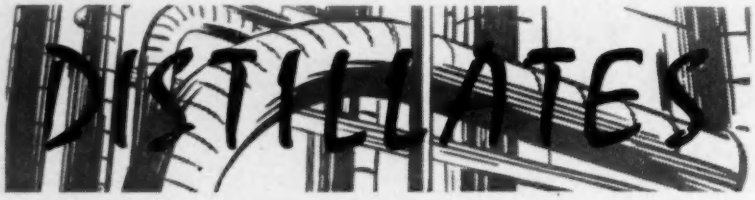
Production of Glass and Ceramic Articles: A project involving an expenditure of Rs 2.65 lakhs for the manufacture of certain types of ceramic articles at the Central Glass and Ceramics Research Institute, Calcutta, has been approved. The articles to be produced will include thermocouple sheaths, furnace and other tubes, furnace plates and muffles, crucibles, combustion boats and porous thimbles, glass articles such as electrodes for pH meters, strain viewers, softening point apparatus, etc.; enamelled articles like telephone dials and enamelled C.I. jumper rings for telephone wiring; and enamelling stains.

New Research Institutes: The Oil and Natural Gas Commission is proposing to set up a National Institute for Petroleum Technology at Dhanbad. The institute will train technical personnel needed by the expanding public sector of the oil industry.

With the opening of the building and laboratories of the South India Textile Research Association (S.I.T.R.A.) at Coimbatore in October last, another industrial co-operative research organisation has come into existence. S.I.T.R.A. will be mainly concerned with fibre research, development of new processes, laying of standards for processed materials.

Welding of Thermoplastic Materials

A joint committee sponsored by the Institute of Welding, the Plastics Institute and the British Plastics Federation has been set up to consider the technological needs of industry as regards the welding of thermoplastic materials and to take such action as it can to meet those needs.



★ ONE of the surprise moves of the new year was the French liberalisation of dyestuffs imports so far as O.E.E.C. member-countries are concerned. Now that dyestuffs and pigments are free of quantitative restrictions, new export opportunities will open up for British producers. Eventually, of course, as the tariff wall of the European Common Market countries builds up, British producers will be effectively excluded.

In the meantime, the British dyestuffs industry must be wondering what result, if any, the French action is likely to have on the British import situation. It seems to me that strong pressure is likely to be brought to bear by France on other O.E.E.C. member-nations to follow the French lead and to liberalise imports. That could prove embarrassing to an industry that has enjoyed protection for so many years.

★ A NEW type of exhibition, to be held at Olympia in October next year, will put science, in all its aspects, on show both to the specialist and the public. The International Scientific Research Exhibition is being organised to illustrate the story of scientific achievement; to demonstrate the influence scientific development plays in our daily lives; to explain the promise scientific discovery and research holds for the future.

Four main themes have been chosen as the pattern for the exhibition: health and food; materials; transport and communications; power and industry. Universities are being encouraged to take part so that they can make known the important part they are playing in modern technical and scientific research.

I am told that the visitor will be able to start from a point on the 'Avenue of Discovery' and follow a piece of research from the point where it was an idea in somebody's mind through the various stages of development to the finished product.

★ THE teaching of science in our schools, or lack of it, has been the subject of much controversy. One of the main bones of contention so far as the Public Schools are concerned is that the Common Entrance Examination does not recognise science.

The Minister of Education has stated that the capital cost of providing science laboratories in maintained schools is £2 million; there are 8,195 such schools or departments at secondary school levels which may be expected to have facilities for the teaching of science. Dame Kathleen Lonsdale writing in *The Times* last week asked 'Is it too much to expect that the country might spend at least the price of a nuclear power station on providing the laboratories in which our future scientists (and politicians) will be trained?'

With all this criticism I was heartened to learn from the Royal Society this week that its Committee on Scientific Research in Schools, set up in 1957, now reports that research projects are being carried out at 20 schools of all types and that a further 19 are considering research projects. Projects now in progress include chromatographic investigations, diazotisation problems, elastic constants of crystalline materials; enzyme catalysed hydrolysis reactions; equilibria between similar ions; hydrocarbon oxidation and amines; nitration and nitrosation by tetranitromethane; redox titration of organic compounds; and solubility of common gases in hydrocarbons.

All these projects have been scrutinised by fellows of the Royal Society, many of whom have lent items of apparatus. In addition a number of the projects are assisted by Shell Research Ltd., whose general manager, Dr. C. G. Williams, is a member of the committee.

★ ONE of the most useful Government services to U.K. business—and one of the least publicised—is the Special Register Information Service of the Board of Trade Export Services Branch. Operating from Lacon House, Theobalds Road, London W.C.1, this provides British business with a flood of information on industrial developments overseas, surveys of specific markets for British products, news of tenders, etc.

Two items of interest that have recently come to my notice are tenders put out for chemical plant. The first deals with a pilot plant at Vreoci to demonstrate the Fischer-Tropsch synthesis. The Yugoslav import enterprise Rudar, Kolarceva I/IV, P.O.B. 568, Belgrade, also wish to receive information from U.K. firms who can supply equipment for the chemical utilisation of coal (gasification under pressure, semi-coking, Fischer-Tropsch synthesis, etc.).

The second concerns the Acquedotto di Napoli Gestione Municipale, Via Costantinopoli 98, Naples (320), who seek U.K. tenders for the supply of a demanganisation and partial softening plant for the domestic water system.

★ AMID all the publicity concerning the 'Small World' and the balloon's crew I was interested to learn of the contribution that the British chemical and plastics industries made in terms of equipment and supplies. I.C.I. for instance, supplied 1,000 yards of Terylene for the balloon which was neoprene-coated by R.F.D. Co. Ltd., Godalming. A feature was the exceptionally low gas permeability.

The gondola, made of expanded polystyrene, was reinforced and coated with a Terylene laminating fabric that had been pretreated with isocyanates to give extra adhesion. The material was woven by Fothergill and Harvey Ltd., Manchester. Plaited Terylene ropes were used for the height control device and for the grapnel line, while sails and drogues and safety harnesses were also in Terylene.

Polystyrene sections of the gondola were bonded with Araldite epoxy resin by Ciba (A.R.L.), Duxford, and the Terylene skin was also bonded on and coated with Araldite.

R.F.D. tell me that the Terylene balloon was coated both inside and out with black-compounded neoprene proofing. The upper two-thirds of the exterior were finished off with aluminium surfacing. Adhesion was taken care of by a special bonding process. The seams which overlapped, were externally taped with neoprene; the adhesive, Boscoprene 2400, was supplied by the B.B. Chemical Co., Leicester. Rubber-proofing of the balloon was successfully handled by Greengate and Irwell, Manchester.

★ IN my reference to tests on the toxicity carried out on Abril Waxes OS, 10DS, E and S at the Nutritional Research Unit, Huntingdon (Distillates, 13 December), I erroneously described this unit as being under the aegis of the Medical Research Council. It is in fact an independent organisation mainly concerned with problems relating to toxicology.

★ A NEW and major market for polythene is seen by U.S. Industrial Chemicals Co., 99 Park Avenue, New York, in the recent development of polythene-coated corrugated board. If polythene could find application in even 1% of the 6,879,000 tons of corrugated board produced in 1957, it would amount to 68,794 tons of polythene-coated board. That represents almost twice the combined tonnages of paper and paperboard that were extrusion coated with polythene in 1957. The potentialities of the market are realised when it is known that according to U.S.I. about 20 million lb. of polythene were used in 1957 for the extrusion coating of those substrates.

A new type of corrugated board, incorporating a moisture and grease-proof polythene coating has been developed by Mead Board Sales and Mead Containers of Cincinnati. It is coated with U.S.I.'s Petrothene resin 205. For most applications, which include food packing and the shipment of highly polished items, the coating is on the inside of the container and in such cases the polythene-coated Kraft is applied to the single-face side. It has also been found possible to run the material on the opposite side of the board.

Alembic

ENORMOUS CAPITAL OUTLAY ON CHEMICALS 'MUST BEAR FRUIT'

LATEST available official statistics reveal that overall production within the chemical industry was maintained at about the same level in 1958 as that achieved in 1957. This is stated in the annual report for 1958 of the Chemical and Allied Trades Section, Manchester Chamber of Commerce. The official index showed that while by June 1958 production for the whole of U.K. manufacturing industry had increased by 43% since 1948, production in the chemical industry was 92% higher than 10 years previously.

Output of general chemicals in 1958 showed some slight reduction, however, and the maintenance of the previous year's figure was probably only achieved as a result of some expansion in the field of mineral oil refining. (See also CHEMICAL AGE, 10 January.)

In view of the steady growth in production during the post-war years, the absence of any increase over 1957 might well cause disappointment at first sight, states the report, but on reflection it gives cause for some satisfaction as it had been achieved in face of a declining demand from some sections of home industry and of intensified competition overseas. It did not represent any halting of the industry's progressive policy for capital investment had continued almost unchecked, with particular attention being paid to automation and work study.

Good Labour Relations

Labour relations in the chemical industry during 1958 were particularly satisfactory. While the total number of stoppages of work through industrial disputes in the U.K. during the first 10 months was 2,333, the chemical trades had been responsible for only two.

While it was difficult to make a forecast of future trends, it was believed that the chemical industry could view the coming year with confidence for sooner or later the enormous capital outlay and research expenditure made during the last few years must bear fruit whatever the short-term restrictions and disturbances might be.

The section states that disappointment was registered in most sections of the chemical industry at the absence of progress in European Free Trade Area, and indeed it appeared extremely doubtful whether anything along the lines originally envisaged would ever emerge. The Continent took a large slice of U.K. chemical exports and the threat of having tariff barriers to surmount in addition to the already fierce competition from continental suppliers gave cause for some concern.

Dyestuffs. The level achieved in 1958 by the dyestuffs section would undoubtedly reflect the difficult conditions which have prevailed in the textile trades. Exports of dyestuffs themselves had fallen substantially, particularly those intended for use on textiles in line with the depressed state of trade which seems to have affected textile industries in most countries.

It would appear that there is not likely to be any substantial improvement before the early part of 1959 and there are so many uncertain elements in the situation that it is difficult to make a long-term forecast. (These trends confirm the C.A. survey of sales published last week).

Pharmaceuticals. In the home market business has continued to expand. Although under the National Health Service, the cost per prescription had increased during the year, this increase was largely due to the greater use of some of the newer drugs including the corticosteroids which were still costly. The Board of Trade wholesale price index number for drugs and pharmaceutical preparations actually fell from 99.3 in October 1957 to 97.5 in September 1958 (1954 = 100).

Lubricating Oils and Greases. There was every indication that the output of oil from British refineries was increasing year by year. Consumption of lubricating oils and greases was keeping at a steady level. Industrial expansion and scientific development were demanding new and specialised lubrication and in the past year the oil industry had kept pace with this trend.

Prices and supplies had shown an easier tendency, due in the main to lively competition, which is a true sign of the healthy state of affairs in the trade throughout the year, but this was unlikely to continue to develop any further under present conditions.

From time to time there were amalgamations of interests and on the whole the trade was unified and organised, busily engaged in satisfying all requirements.

New Fast-Curing Glass-fibre Polyester Dough Moulding Material by Bakelite

FAST-CURING glass-fibre mineral-filled polyester dough moulding material, DX18927, is announced by Bakelite Ltd. The new material is stated to offer a valuable combination of high mechanical strength, excellent electrical properties and good water resistance, track resistance and dimensional stability. Moulding with these properties can be made from this material at lower cost, it is claimed, than from conventional alkyd or phenolic glass-fibre reinforced moulding materials. Although not quite as strong as the latter mechanically, DX18927 is in many ways reported to be easier to handle and mould. It is soft and can be preformed readily by hand without preheating. Because of its free flow and rapid cure, components of relatively complicated design and thick sections can be moulded by normal compression methods.

Applications suggested for this material is where high mechanical strength is required and especially where inherent properties such as good track resistance, water resistance, electrical properties and dimensional stability, would also be an advantage. Such applications include contactor bases, fuse boxes, terminal boxes, switchgear components, barrier strips and insulators of all types.

Mouldings in DX18927 have good heat resistance, it is reported. They lose their surface gloss when heated to 180°C (355°F) for long periods, but retain a high proportion of their mechanical strength and show only small changes in weight and dimensions.

Temperatures of 130° to 160°C (265° to 320°F) and pressures of ½ to 2 tons/m.² have been used satisfactorily for moulding this material. The preferable temperature is 150°C (300°F) and a pressure not exceeding 1 ton/in.². Where sections are thicker than ½ in. to ¾ in. a 5 to 10 minutes preheat at 60° to 70°C (140° to 160°F) has been found useful in preventing internal porosity.

The material cures rapidly and satisfactory mouldings have been produced at 150°C using the following cure times: ¼ in. thick, 1 minute; ½ in. thick, 5 minutes; and 1 in. thick, 10 minutes.

Other relevant technical data on DX18927 is obtainable from Bakelite Ltd., 12-18 Grosvenor Gardens, London S.W.1.

Mechanical properties:	
Sp. gravity	20–21
Impact strength (ft./lb.)	2.5–40
Gross breaking strength (lb./in.²)	13,000–18,000
Tensile strength (lb./in.²)	5,000– 7,000
Electrical properties:	
Power factor at 800c/s (tan A)	0.01–0.05
Permittivity at 800 c/s	5.5–6.5
Power factor at 10^6 c/s (tan A)	0.015–0.020
Permittivity at 10^6 c/s	5.0–6.0
Vol. resistivity: 20°C (ohm-cm.)	
Freshly moulded	$> 10^{14}$
After 24 hrs. in H_2O	10^{14}
Surface resistivity 20°C (ohms)	
Freshly moulded	$> 10^{14}$
After 24 hrs. in H_2O	10^{13}–10^{13}
Electric strength at 90°C (V/ml.)	200–300
Water absorption (mg.)	40–100

Resistance to electrical tracking: Mouldings pass cracking test described in B.E.A. I.R.A. Reports A/T. 136.

Carriage of Dangerous Goods in Ships

Amendment List No. 2 to the 1957 report of the standing advisory committee on the carriage of dangerous goods and explosives in ships is now on sale at H.M. Stationery Office, price 7s. 6d. The alterations to Section 1 (the explosives section) of the report have also been published separately as Amendment List No. 2 to the "Rules for the Packing, Stowage and Labelling of Explosives for Carriage by Sea" and may be obtained from H.M. Stationery Office, price 3s.

New Calcination Process for Disposal of Atomic Wastes Under Development in U.S.

REPRESENTING a major new start in the field of waste disposal is the large-scale waste calcination pilot plant now being built at the National Reactor Testing Station, Idaho, US. At present, when used nuclear fuels are removed from reactors and processed to recover valuable fissionable materials for re-use, the highly radioactive and corrosive liquid wastes that result from the solvent extraction process are stored in underground steel tanks.

In the new process liquid wastes are converted to solid form and their volume is reduced to about one-seventh of the original bulk. It is hoped that it will also make the waste less corrosive and correspondingly easier to store. The process, called calcination, involves evaporating the water, decomposing the nitric acid to oxides of nitrogen, and converting aluminium nitrate to aluminium oxide. The process yields a granular solid alumina product containing all fission products removed from the fuels except those contained in the dust entrained in the calciner fluidising air. These products are removed by scrubbing and filtration techniques. A portion of the ruthenium volatises in the calciner, and is separated by adsorption. Since some of the highly radioactive fission products must decay for periods as high as 800 years before they can be safely discharged to water and air, the value of this process which 'fixes' the radioactivity in a less mobile form is immediately evident. This type of treatment will not impair the preliminary or subsequent separation of special fission product values (radioisotopes) for industrial utilisation.

Research Work

Research work for the process is now being conducted by the Atomic Energy Division of Phillips Petroleum Co. at the National Reactor Testing Station, and by Argonne National Laboratory. This work is still in progress, and most process uncertainties, it is understood, will be resolved before the plant begins to operate. However, the fundamental purpose of the plant, estimated to cost about $6 million, and being built by Fluor Corporation Ltd., Los Angeles, California, will be to demonstrate feasibility on an engineering scale. Process development will continue during plant shakedown and operation so as to allow maximum utilisation of new technology. Construction work is scheduled to be completed by 31 January 1960.

Conversion of liquid wastes to solids is accomplished by fluidised bed calcination, using hot air as the fluidising medium. In passing through the calciner the air becomes contaminated with radioactive materials, and must be thoroughly decontaminated before it is discharged back to the atmosphere. The calciner is a cylindrical vessel containing at steady state a bed of granular aluminium oxide consisting of the product obtained from the evaporation and calcination of the waste solution. The bed is supported on a perforated or porous plate which serves as a gas distributor. Preheated air is passed upward through the plate to fluidise the bed and agitate the solids. The entire mass is stated to behave very much like a vigorously boiling liquid.

Additional heat is supplied to the solid particles (aluminium oxide) through heat transfer tubes within the bed itself. The bed temperature is maintained in the range of 400°-500°C. The waste solution is injected into the bed through several spray nozzles spaced around the calciner. The liquid droplets, on contacting the hot solid particles, are flash-dried and calcined to oxides.

The calcination facilities are designed to process aluminium nitrate wastes that have decayed at least 200 days after discharge from the reactor. Initial operation will be with two-year-old waste; because of longer radioactive decay it generates less heat and thus will facilitate the first observations made on solid waste materials.

Because of the radioactive nature of the materials handled the process equipment is housed in concrete cells to shield operating personnel. The possibility of spreading cell contamination is reduced considerably by designing the facility for negative pressure operation throughout. Cells are arranged to facilitate processing, maintenance and subsequent modification for process improvement.

Work to date has indicated that fluidised bed calcination of radioactive wastes should be economically competitive with liquid storage and have less hazard potential.

Cryopumping—New U.S. Way to High Vacuum Technology Developed

NEW approach to high vacuum technology, developed by Arthur D. Little Inc. research workers is 'cryopumping.' It is based on the principle that if air or other gas in a container is cooled to a low enough temperature it will condense and leave a vacuum.

Advantages of cryopumping over conventional vacuum techniques are reported as being most impressive when very low pressures, very high pumping rates, or both are involved. Pumping rate increases exponentially as the pressure decreases and pressure drops as the cooled gases condense.

A pumping rate of 10^6 l. per sec. at 10^{-5} mm. would require 2,000 h.p. of diffusion pump capacity compared with less than 70 h.p. for cryopumping. Some 200 diffusion pumps of the maximum size normally available (10 h.p.) would be needed at a cost of about $800,000. The cost of the single cryopump of the necessary capacity would be about $80,000.

The cryopump consists of a low temperature refrigeration unit which circulates gaseous helium at 20°K. through coils in plate condensers. As the cooled gases condense, the pressure drops. The limiting pressure is the pressure of those gases that do not condense at 20°k. The partial pressures of neon, hydrogen and helium in air (the normal low-boiling constituents of atmosphere) total a little less than 0.1 mm. mercury and this is the theoretical limit for cryopumping. Mechanically pumping down to 1 mm. will permit cryopumping to about 10^{-7} mm. and flushing the system thoroughly with high pressure nitrogen to remove non-condensables is expected to permit pressures as low as 10^{-8} mm. or better. To reduce the time, a mechanical pump is required to take the pressure down to between 1 mm. and 0.1 mm.—the range where cryopumping becomes effective. The refrigeration unit requires 50 h.p.

Capital cost of equipment to produce temperatures in the vicinity of 20° k is estimated by Arthur D. Little to have been reduced over the last few years from about $100 per B.Th.U. per hour to about $20 to $4.0 For installations where high rates of flow at very low pressures are needed, cryopumping is suggested as being the answer. Cryopumping is being used in the new hypersonic wind tunnel of the University of Southern California which has been designed to study hypersonic rarified gas flow. It can operate continuously for five hours or more. The only moving part of the whole tunnel installation is the refrigeration unit.

E-Mil Long Service Awards

H. J. Elliott Ltd., E-Mil Works, Treforest Industrial Estate, Pontypridd, manufacturers of E-Mil brand of laboratory glassware and thermometers, are to make presentations to all employees with 25 years' service. The first of such awards, consisting of gold wrist watches, were made by Mr. H. J. Elliott, founder director, now in his 82nd year, to three members of the staff. Mr. G. C. Devereux, manager of the technical and development division, who has completed 40 years' service, was presented with a pair of binoculars in addition to the gold wrist watch. Other presentations were made to Mr. E. W. Fish, foreman of the graduating department, who has over 34 years' service, and Mr. W. A. Broad, superintendent of the thermometer department, with 25 years' service.

COAL TAR TECHNOLOGY, 1958

World-wide Progress Reviewed By Coal Tar Research Association—2

THIS report concludes our summary of the 'Review of Coal Tar Technology,' January-June, 1958, Vol. X, Part I, published by the Coal Tar Research Association. See also CHEMICAL AGE, 10 January, p. 91.

Analysis of Tar Acids. Converted into their oxyacetic acids, tar acids have been analysed by paper partition chromatography. The chromatograms were developed with a mixture of butanol and ammonia and the spots revealed by means of the reagent sodium 2-(2:4-dinitrophenyl azo)-1-naphthol-3:6-disulphonate. From the R_F values given, it appears that most binary mixtures of phenol, cresols or xylenols can be separated by this technique (*Kôgyo Kagaku Zasshi,* 1956, **59**, 546, K. Negro).

Tar Bases: High Purity Quinoline. A Japanese patent (P. 5720 ('57) claims that by counter-current application of 2N hydrochloric acid and benzene to a 53:47 mixture of quinoline and *iso*quinoline a benzene layer is produced from which quinoline of 99.5% purity may be obtained.

Monocyclic Aromatic Hydrocarbons. Production of xylenes by disproportionation of toluene and polyalkyl benzenes has been brought about by passage through a 'boiling bed' of microspherical aluminosilicate catalyst at elevated temperature and atmospheric pressure. A mixture of toluene and polyalkyl benzenes (chiefly mesitylene and pseudocumene) reacted at 480°C gave a 28% yield of xylenes (predominantly *meta*) (*Doklady Akad. Nauk., S.S.S.R.,* 1957, **117**, 1007; *Bull. Inf. S.G.I.G.B.,* 1958, No. 1, TB 24).

Concentrating p-Xylene

A continuous crystallisation process for concentrating *p*-xylene is that of Phillips Petroleum Co. (U.S.P., 2,815,364). The feedstock is partially crystallised by cooling to 10°F, and the crystals separated from the mother liquor. These are then moved through a purification zone to a melting zone; a portion of the melted material is withdrawn as the product and the remainder used as a reflux stream moving counter currently to the crystals in the purification zone. A feed material containing 65.5% of *p*-xylene was processed to give a product containing 88% of the compound.

Separation of xylenes by treatment with a carbon halide so as to form a complex with one of the isomers is claimed in Dutch patent (P. 84,412). The solid complexes, it is suggested, may be used as such in pesticide or detergents. Separation of substituted aromatics such as cresols, toluidines and lutidines, in addition to the xylenes, is also mentioned.

Oxidation of benzene, toluene and other aromatics to maleic anhydride, using oxygen at about 350°C in a static or fluidised catalyst bed of molybdenum and vanadium oxides, activated by oxides of cerium, chromium or phosphorus is claimed (B.P. 790,559).

Terephthalic Acid Production. Japanese workers have carried out studies on the effects of reagent concentrations and reaction conditions on the oxidation of *p*-xylene to terephthalic acid at 60 to 90°C, using manganese dioxide and sulphuric acid. The best yield, 73.5%, of terephthalic acid was given by a 9:1 molar ratio of manganese dioxide to *p*-xylene, and a total reaction time of 13 hours. Experiments were also carried out using *p*-cymene and *p*-chloromethyl toluene. The yield improved on addition of traces of vanadium pentoxide, ammonium vanadate, chromium trioxide or mercuric oxide. (Kôgyô Kagaku Zasshi, 1956, **59**, 690.)

Separation Process

Naphthalene. C.T.R.A. has been granted a patent (B.P. 793,773) for the separation of coal tar components by reaction with 40% aqueous formaldehyde and 80% sulphuric acid. The more reactive components are resinified leaving the more inert compounds in a purer state. In an example the thionaphthene content of a commercial naphthalene was reduced from 0.93 to 0.017%. A Henkel and Cie patent (B.P. 789,709) states pure solid components may be removed from a slurry, such as naphthalene oil, by mixing the slurry with an aqueous solution of an emulsifying or dispersing agent, the specific gravity of which is at least equal to that of the solids in the slurry. The mixture is then centrifuged in an imperforate-wall centrifuge to give two phases, the aqueous phase containing the solids in suspension. The production of naphthalene of 79.7°C crystallising point is described.

Russian and other data are quoted by Goftman and Kharlampovich (*Koks i Khim,* 1958, No. 1, 53) to show that the use of naphthalene oil as raw material would treble the quantity of raw material available and at least halve the cost of phthalic anhydride production.

Processes for Anthraquinone. American Cyanamid Co. is to build an anthraquinone plant which will employ a new process developed by the company. Known as the naphthaquinone process, it involves direct oxidation of naphthalene in a fixed-bed catalytic converter. The plant will also provide additional capacity for methyl anthraquinone, naphthaquinone and phthalic anhydride.

According to Japanese work, electrolysis of pure anthracene suspended in 40% sulphuric acid containing 2% vanadium pentoxide or ceric sulphate yields 90% of pure anthraquinone, with a current efficiency of 60%. (*Chem. Abs.,* 1958, **52**, 8794 (10 June), K. Shirai and K. Sugino.) Koppers Co. (B.P. 796,395) have described a process in which anthracene is oxidised with 98% nitric acid at at least 150°C, to give pure anthraquinone; nitrobenzene is used as solvent for the product. Anthraquinone, melting at 284-286°C, was obtained in over 65% yield

Plastics and Resins. Two Japanese patents are concerned with the preparation of cation-exchange resins (P. 1742 ('57) and P. 2239 ('57)). A German patent records that *cyclo*pentadiene can be polymerised with aromatic hydrocarbons containing reactive double bonds, e.g. styrene indene or coumarone, to yield light-coloured resins. The coatings produced are light-coloured, fast-drying and light-stable, and have good adhesion to wood and metals.

The polymerisation of unsaturated fatty acids and *cyclo*pentadiene with aromatic hydrocarbons from coke-plant light oils is also claimed (German P. 926,810).

A two-stage process for the preparation of high-molecular weight copolymers of styrene and *iso*butylene by low temperature Friedel-Crafts polymerisation has been developed by Esso Research and Engineering Co. (U.S.P. 2,800,465).

Polymerising Styrene

C.S.I.R.O. Coal Research Section in Australia has investigated the polymerisation of styrene, and mixtures of styrene, indene and coumarone, in coal tar naphthas. Cationic catalysts, e.g. BF_3/acetic acid, with styrene in Australian vertical retort naphtha gave viscous polymers, yielding solid resins on further distillation. Colours of these styrene resins were similar to those of coumarone/indene resins, but softening points were lower. Thermal polymerisation of styrene and/or coumarone/indene in sealed glass tubes required several days for completion; the styrene resins were of good colour and softening point. Thermal polymerisation of naphtha in sealed tubes at 200°C was found to give the best resins of pale yellow colour and softening points of 90 to 100°C. (C.S.I.R.O. Coal Research Station, August 1957, Ref. M. 125). A Japanese patent (P. 790 ('57)) states that Lewis acid catalyst may be used to polymerise solvent naphthas containing coumarone and indene to give resins with softening points of about 160°C.

Pesticides. Rhône-Poulenc have introduced a fungicidal plastic agent comprising an anthracene oil fraction (b_{10} 95 to 140°C) and polyvinyl chloride. It is claimed it provides a fungicidal atmosphere and it can be applied to other plastics or materials requiring protection (German P. 929,824). U.S.P. 2,823,158 indicates that carbazole, treated with acrylonitrile, gives N-cyanoethyl carbazole which can be applied, as a dust or in aqueous dispersions in concentra-

tions of 30-1,000 p.p.m. to treat systemic plant diseases.

Catalytic Chemistry. Catalytic cracking of xylenes with water vapour in the presence of catalyst containing 33% and 47% of nickel on alumina is reported from Russia (*Chem. Abs.*, 1958, **52**, 279, 10 January, A. A. Balandin *et al.*). The reaction was carried out at 350° to 450°C and a water/hydrocarbon ratio of 5:1. *Meta-* and *para*-xylenes gave 60 to 80% of toluene and not more than 20% of benzene and other gaseous products. *Ortho*-xylene gave 46% of toluene at 410°C and 27% at 460°C. A Japanese process (P. 6431 ('56)) is described for cracking coal tar oils, of boiling range 180° to 320°C on hot coke at 680°-750°C to yield 60% of a tar which can be distilled to give an oil of boiling range 120-290°C, containing 92% of aromatic hydrocarbons. The cracker gas contains 44% of olefins; 370 l. of it are produced for each kilogramme of feed.

Dehydrogenation Catalyst for Styrene. This has been prepared having a good life, activity and selectivity, by precipitation at 90°C of a 30% zinc sulphate solution with 20% sodium carbonate until the pH was 7.5 to 8.0, followed by thermal decomposition at 450-650°C. (*Chem. listy.*, 1957, **51**, 1593.) A U.S. patent (U.S.P. 2,814,650) describes a catalyst suitable for hydrogenation or dehydrogenation prepared by subjecting molybdenum and/or vanadium oxides to hydrogen and ammonia at 950° to 1,300° F for periods longer than 30 minutes.

Desulphurisation. Purification of hydrocarbon oils is reported by Metallgesellschaft A.G. (German P. 930,233). Removal of organic sulphur and/or nitrogen compounds, from coal-derived oils boiling below 400°C is carried out in the presence of sulphur-resistant catalyst using hydrogen or a gas mixture containing hydrogen and carbon monoxide. Preferred conditions are temperature below 330°C, hydrogen partial pressure less than 25 atmospheres and carbon monoxide partial pressure 0.1 to 15 atmospheres (when a mixture is used). Japanese workers have studied the catalytic desulphurisation of naphtha over cobalt/molybdenum catalyst and have determined the rate equation for the reaction. (*Chem. Abs.*, 1958, **52**, 5798 (10 April) T. Shiba and T. Nagata.)

Sigmund Pumps Used In New Petrochemical Plants At Fawley

MORE than 50 Sigmund process and chemical pumps are used in the new petrochemical plants recently brought into production at Esso's Fawley Refinery. (See CHEMICAL AGE, 13 December, p. 982.) To meet the different applications and operating conditions the Sigmund pumps ordered include single stage (both single and double suction impellers) and multi-stage horizontal pumps, and the vertical shaft glandless pump handling, in this instance, liquid sulphur.

Operating temperatures range up to 495°F, while the pumps on some services provide differential heads of over 1,000 ft. Liquids handled include caustics, acids and oils, necessitating various grades of corrosion resistant materials in the pump construction. Mechanical seals were fitted to the horizontal pump throughout the contract, the appropriate types being selected in consultation with the makers, Crane Packing Ltd.

Of the pumps supplied more than half are of the K-N single stage, process range. This range covers outputs up to 540 imp. g.p.m. and heads up to 260 ft., all the units using the same interchangeable components for shaft and bearing housing assemblies, and the design is suitable for operating temperatures up to 400°F. Renewable case and impeller wear rings are fitted; these and the renewable shaft sleeves fitted on soft packed pumps are manufactured in materials to suit the application, the shaft sleeve being hard faced with Stellite or Colmonoy if required.

Use of Sigmund K-N pumps at Fawley means that, for some 27 units, the wetted parts only are not completely interchangeable throughout the plant, although many of them are, in fact, dimensionally matching items also. The complete bearing housing, support, coupling and bedplate assemblies are all interchangeable, so that the same spares can be used on any of these pumps.

The effective economy which this produces in assessing spares requirements on a continuous-run process is an example of the value of careful pump selection using a range designed on a basis of standardisation of parts.

A.E.A. Opens New Information Centre

AN Information Centre has been opened at the London Office of the U.K. Atomic Energy Authority to provide a convenient centre in London where members of the public, commercial firms and other organisations can consult published unclassified material and seek advice on sources of information on U.K. atomic energy matters. A collection of A.E.A. unclassified reports is available for reference. Indices and abstracts of atomic energy literature are filed and publications about the work of the authority are available.

The facilities which it offers are complementary to the already well established information services provided at Harwell, Risley and, to a limited extent, Aldermaston, for dealing with scientific and technical inquiries.

The centre is open from Mondays to Fridays inclusive between 9.30 a.m. and 5 p.m. at the A.E.A., 11 Charles II Street, London S.W.1 (Whitehall 6262, extensions 174 and 176).

B.o.T. Chemical Price Index Shows Decrease for November, 1958

WHOLESALE price index of the U.K. chemical and allied industries during November is shown in the Board of Trade monthly price index as being 103.9 (provisional) against 104.1 in the previous month. This figure is for total sales, the index for home market sales only being 105.2 (provisional), against 105.1 in October. The following data is extracted from the index, which is based on 1954 = 100.

Product	Nov. 1957	Oct. 1958	Nov. 1958
Commodities Produced in the U.K.			
Chemical and allied industries:			
Total sales	105.9	104.1	103.9%*
Home market sales	106.7	105.1	105.2%*
Dyes and dyestuffs	111.1	110.4	110.4%*
Disinfectants	112.4	112.9	112.9
Fertilisers	116.5	114.2	114.7
Insecticides, weedkillers and fungicides	95.0	92.9	92.9
Synthetic resins and plastics materials	94.5	91.7	91.7%*
General chemicals	109.2	107.1	107.1%*
Benzole, pure, B.S. 135A-1950	106.9	106.9	106.9
Caustic soda liquor, 100 T.W.	116.3	116.3	116.3
Soda ash, light, delivered	115.3	115.3	115.3
Soda ash, light, f.o.r. wks.	117.7	117.7	117.7
Sulphuric acid, B.O.V.	114.4	102.2	102.2
Sulphuric acid, R.O.V., 94-95%	111.2	99.4	99.4
Drugs and pharmaceuticals	99.3	97.1	97.2%*
Synthetic detergents	102.6	104.3	103.8
Ethyl alcohol industrial, B.S.507-1933	159.6	146.2	146.2
Commodities Wholly or Partly Imported			
Linseed oil, crude, spot, London, bulk, ex. tank	135.5	134.2	135.4%*
Pyrites, c.i.f., U.K. ports	95.6	74.1	74.1
Sulphur, crude (for acid making), c.i.f.	96.6	80.0	80.0

* Provisional.

New B.S. for Coal Tar Oil Distillates

A NEW British Standard for coal tar oil types of wood preservatives (other than creosote to B.S. 144) and numbered B.S. 3051/1958, deals with two types of coal tar oil distillates which fall outside the scope of B.S. 144, which have given satisfaction as wood preservatives for many years. The first type is obtained from high-temperature carbonisation processes, the second from other carbonisation or gasification processes. As wood preservatives, these distillates are primarily suitable for the hot-and-cold dipping process or for brush treatment of the wood.

The specification follows the general pattern of B.S. 144 in prescribing requirements for specific gravity, liquidity, water content, distillation range, phenols and matter insoluble in toluole. In addition, limits are specified for flash point and saturated hydrocarbons. Sampling and test methods are based on the recommendations of the Standardisation of Tar Products Test Committee. Copies of the Standard may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London W.1. Price 5s.

Overseas News

CANADIAN CHEMICAL INDUSTRY LEADERS REVIEW PROSPECTS FOR 1959

PRODUCTION in Canada this year will exceed that in 1958, states Herbert H. Lank, president of Du Pont Co. of Canada Ltd., although it will not be as vigorous as previous recovery movements. Sales in a number of lines, he warns, could be disappointing, due to a decline in support capital investment. Favourable elements, compared with a year ago are that business in the U.S. is on the ascendancy, inventories have been reduced, purchasing power is high and, very important, the confidence of management and consumer has been restored.

This more optimistic outlook, however, is combined with a fear of inflation. Pressure on costs is so insistent that prices are rising despite the fact that demand for most products is below available supply. Fiscal and monetary measures taken to curb the price rise could affect demand adversely, adding to the problem of unemployment and idle plant capacity.

According to the vice-president of Canadian Industries Ltd., Leonard Hynes, the growth potential of the Canadian chemical and allied products industry, even under adverse economic conditions, was further demonstrated during 1958. The industry's production reached a record value estimated at about 7% above that for the previous year, representing an increase in physical volume which came close to the average annual growth rate of the post-war year. The indications for 1959 are that a further advance in production rates will be achieved and Mr. Hynes anticipates increased demand for chemicals.

Capital Investment

Capital investment in the Canadian chemical industry fell during 1958 by an estimated 10% to 15% below the $149 million invested in 1957, although it was still at a very high level due, largely, to completion of, or initiation of new projects. There have been few recent announcements of large new chemical projects, suggesting a further decline in capital expenditure this year. However, C.I.L.'s vice-president expects chemical consumption in Canada to continue to stimulate the industry's growth.

Rising sales and profits for the chemical industry are predicted by the president of Monsanto Canada Ltd., Leo E. Ryan. The industry had shown an amazing resistance to recession. Despite manufacturing in general dropping 10% below normal levels in 1958, chemical manufacturing had increased by 2%. Previously a 6% to 10% annual increase in chemical production had been experienced in Canada with plastics showing a growth of 30%.

Sales had remained fairly steady in 1958, although profits had not. Capacity to produce for the larger market already existed, but because units were not operating at the anticipated capacity, costs had risen. Wage rates and chemical raw materials prices had also contributed to increased costs. Better operating ratio was looked for this year.

American Chemical Corp. Plan $7.5 m. Petrochemical Plant

A new petrochemical plant, costing $7.5 million, is to be built this year by American Chemical Corporation, jointly owned by Richfield Oil Corporation and Stauffer Chemical Co. The site chosen for the new plant is near Richfield's refinery in Watson, California.

A.K.U.-Goodrich Synthetic Rubber Plant due in by Mid-1959

At about the middle of 1959, Algemene Kunstzijde Unie N.V. is expected to start production of synthetic rubber in co-operation with the Goodrich Chemical Co. of the U.S. This year the Dutch company will also turn its interest to the fields of urea-formaldehyde powders, melamine-formaldehyde powders, urea resins and melamine resins manufacture.

Production by A.K.U. in 1958 of its own product, Akulon, and of carboxymethyl cellulose (CMC) and viscose products had been satisfactory. Total investment over the year was rather below that for 1957.

Funds for Israeli Chemical Firms

The Washington Export-Import Bank has just granted a credit of I£755,000 to Kadimah Chemical Corporation, Haifa, to finance the expansion of its petrochemical department. This bank has also granted a credit of I£125,000 to Serafon Resinous Chemicals Corp. Ltd., Rehovot, to provide increased capacity for the polymerisation and coating departments.

P.V.C. Expansion in East Germany

Work has begun on the building of a plant for the production of p.v.c. powder on the premises of the East German chemical concern Elektrochemisches Kombinat Bitterfeld. The plant will come into operation in 1960. During 1959 the Bitterfeld concern will expand production of all raw materials for plastics. With the opening of the new plant and the building up of production in former installations, the company's p.v.c. powder output is to be raised fivefold.

Dutch Import Duties Lowered

Dutch tariffs on certain goods imported from countries outside the European Common Market will be temporarily lowered by 10% from 12 January in order to avoid the discrimination against 'outside' countries which would otherwise result from the general lowering of internal tariffs by 10% among the 'Six'. The goods include benzole, soaps and certain types of ceramics.

Israeli Phosphorus Manufacturing Plant

Agreement has been reached between the Government of Israel and a 'foreign company' concerning the establishment of a plant to manufacture elemental phosphorus near the Oron phosphate mines in the Negev, it is announced. The Israeli Government will incorporate an Israeli company to manage the proposed plant.

The foreign interest, it is stated, will assist in the design and construction of the plant which is to start trials on a full industrial scale within three months. This outside company is to invest an amount equal in nominal value to $750,000 in shares and debentures of the new Israeli company. Elemental phosphorus is to be produced from local phosphate at a rate of 10,000 metric tons annually, with the possibility of increasing capacity to 20,000 tons annually.

Production of Cellulose Film In Yugoslavia

The cellulose factory in Loznica, Yugoslavia, has now started the production of film. About 500 tons will be produced during the current year.

High Temperature Inorganic Lubricants

From the Washington State Institute of Technology, Pullman, Washington, a research team headed by Dr. E. N. Kleingard, have developed solid film inorganic lubricants which can be used at temperatures up to 1,800°F. A new process has been developed whereby chlorine and fluorine compounds can be diffused into the grain boundaries of new nickel alloys that will be used in bearings for space ships of the future. This research has been carried out under a contract from Boeing Aircraft. It is stated to represent a major advance from present permissible temperature levels of less than 1,000°F.

Rumanian-Hungarian National Gas Pipeline is Linked

Rumanian and Hungarian engineers have linked up the 227-mile pipeline which brings methane from Buciumen in Rumania to industrial plants in north-

east Hungary. The gas is for conversion into synthetic raw materials at a new industrial complex which Hungary is building at Tiszapalkonya. The Rumanian gas is extremely pure, with a calorific value of 8,400, and it is calculated that Hungary will take 200 million cu. m. a year through a 7-ft. diameter pipe, 143 miles of which lies in Rumania and 84 in Hungary.

Machinery for the chemical combine at Tiszapakonya has already been delivered by the Soviet Union under a 1958 credit of 110 million rouble. The first part of the combine—the lacquer plant—is due to start production at the end of this year, and building of an artificial fertiliser plant is going ahead; the synthetic raw materials plant will be ready in 1963.

No Renewal of West German Turnover Tax Relief

Regulations granting part-relief from company's 'turnover tax' to certain German chemical industry concerns is not to be renewed, the West German Government have announced. The regulations were introduced in the post-war years and affected particularly, undertakings involved in the anti-trust Acts of those days. They became generally invalid at the end of last year, although the Government has announced that there is to be a considerable waiting period, with a possible reduction in tax due from hardship cases.

Argentina's New Import List

The Argentinian Government has issued a completely new import list covering over 2,000 items. Part I of the list, which covers items which may be imported with no special duty and no cash deposit, includes *inter alia*, 20 raw materials and fire-resistant minerals (e.g., asbestos); part II (20% special duty, no cash deposit), numerous chemicals and pharmaceuticals, optical glass and X-ray film; part III (40% special duty, no cash deposit), further chemicals including aniline and certain basic chemicals for industry; part III (1) (40% special duty plus cash deposit of 50% to 300% of f. and f. worth over 180 days), further chemicals. All items not included in this list, which is taken as being exceptionally harsh, have been made practically unexportable, since they bear a special duty of 300% and a cash deposit of 500% over 180 days.

Orange Free's Demineralisation Plant Successfully Initiated

Demineralisation of hugh quantities of brackish water pumped from the Orange Free State gold field has been successfully initiated. This first plant at Free State Geduld, the largest of its kind in the world, has been run for short periods at a rate of 250,000 gall. per hour, which is a quarter of the ultimate maximum rate intended.

The plant which is a joint undertaking by Anglo American Corporation and the South African Council for Scientific and Industrial Research, will treat 3 million gallons of water daily to produce 2 million gallons for use in the local uranium plants and at other mines.

Increased Plastics Output Expected in W. Germany

An output of 630,000 tons last year, or 13.5 per cent more than in 1957 is expected by the West German plastics industry. This, it is claimed, will place the German plastics industry second in output only to that of the U.S.

Although the rate at which output increased since last year compares favourably with that of West German industry as a whole, it was substantially less than the 25% increase which was achieved from 1956 to 1957. About half of the plastics output is used by the chemical industry in the manufacture of fibres, varnishes and glues. Of the remainder some 30% goes into electrical appliances.

New Becco Epoxy Plasticisers

A new series of epoxy plasticisers—alkyl epoxyhexahydrophthalates—have been developed by Becco Chemical Division of Food Machinery and Chemical, Buffalo, New York. In this series, the stabilising properties of epoxy fatty acid esters have been combined with the plasticising properties of phthalates.

These epoxyhexahydrophthalate esters are made by epoxidising unsaturated tetrahydrophthalic acid esters with preformed peracetic acid or by *in situ* techniques using hydrogen peroxides. Tetrahydrophthalate esters have been made from *n*-butyl, *n*-hexyl, isooctyl, and *n*-decyl alcohols and tetrahydrophthalic anhydride.

It is claimed that these plasticisers protect polyvinyl chloride resins against heat and light degradation and show outstanding compatibility with p.v.c. at high concentrations. Also it is stated that they show no evidence of bleed even after prolonged exposure to either ultraviolet or diffused light.

Suggested applications are in vinyl resin formulations and products such as hose, packaging materials, film, foam and flooring.

Japanese Negotiations For Peruvian Fertiliser Plant

Negotiations are reported to be taking place between Japanese interests and the Peruvian Government on the erection at Chimbate in Peru of a large-scale synthetic fertiliser plant at a cost of 6,000 million yen for which Japan would supply all operating equipment and necessary technical personnel.

West Germany's Chemical Industry Shows Considerable Slowing Down of Development

TOTAL turnover of the West German chemical industry is expected by the West German Association of the Chemical Industry (Verband der Chemischen Industrie e.V.) to be DM18,000 million (about £1,500 million) for 1958, compared with a 1957 figure of DM17,200 million (some £1,434 million). This estimate, which means a considerable slowing down of development, is based partly on the fact that the total turnover for the first three-quarters of the year was 4.4% up on the comparable figures for 1957; these in their turn had been 13.6% higher than the 1956 totals.

Over these first nine months of 1958 production went up by 7.5% on 1957 totals, the index figure of 236 (1938=100) comparing with 220 then. The association says that the seeming disparity between production and turnover must not be taken to mean a disparity between supply and demand; the market was, in fact, quite firm.

Despite increased price pressure on the chemical manufacturer during the year, both in raw and semi-manufactured material prices and in tariffs, prices had stayed remarkably stable. Those for special products rose only three points on 1957 to 205 (1938=100) and for 'consumer' chemicals the index stayed the same at 170 points.

The 1958 development of exports was disappointing for during the first nine months of 1958 exports rose only by 1.6%, by DM55 million (about £4½ million) to DM3,400 million (£284 million approx.). Exports to outside Europe fell almost without exception below 1957 levels (see CHEMICAL AGE, 10 January, p. 99). The Eastern European states bought less German chemicals, the U.S.S.R. forming the only real exception, and this only with about an increase of 14%, despite the recent ambitious trade agreements between the two countries. Within Europe, France, Belgium and Switzerland are buying less chemicals from Germany than formerly.

The one notable exception to the backward tendency in import trade has been provided by the U.K., which increased its imports of chemicals from West Germany by over 11%, from DM166 million (nearly £14 million) to DM184 million (some £15½ million).

Imports into the country during 1958 have risen considerably. In the first three-quarters of last year, a new record value for imports—DM1,280 million (about £106¾ million)—was recorded, an increase of 7.5% on the same period of 1957. Chemical raw material imports fell, however, by the large sum of DM68 million (some £5¾ million) to a total of DM185 million (£15¼ million approximately).

The U.K. developed its exports to Germany as well as its imports from Germany, their value increasing by DM11.3 million (about £941,670) on 1957 totals. West Germany's leading supplier, the U.S., stepped up imports by DM26.7 million (about £2¼ million) to a total for the nine-month period of DM370 million (about £31 million), a new record.

PEOPLE in the news

● MR. K. G. SINCLAIR, chairman of the Griffin and George Group of Companies, leaves London this week-end for a tour of India, Singapore, Australia and New Zealand, returning to the U.K. on 22 March. His goodwill tour coincides with the publication of the group's most recent catalogue of physical and laboratory apparatus, and he will be carrying with him the first copy of this 350-page catalogue. In Australia and New Zealand (30 January-20 March) Mr. Sinclair can be contacted care of the Bank of New South Wales.

● MR. G. K. HAMPSHIRE, chairman of Imperial Chemical Industries' General Chemicals Division, and DR. J. S. GOURLAY, chairman of the Paints Division, have been appointed to the board of I.C.I. as from 2 February.

● MR. D. W. HILLS has been appointed a director of Turner Bros. Asbestos Co., and of Glass Fabrics, subsidiaries of Turner and Newall.

● MR. S. A. DOHM, a director of United Indigo and Chemical Co., retired from the board before the company's annual meeting on 15 December on medical advice. MR. J. B. BRUNDRET, a director retiring by rotation was not re-elected, and MR. F. F. FARAGE and MR. J. LEE-URE have been appointed to the board. MR. J. K. ELLAM has retired from the board while retaining his executive appointment and MR. W. S. HEYWOOD has retired as chairman but remains managing director. MR. G. N. C. FLINT has been appointed a director and chairman.

● DR. R. G. O. KEKWICK, Ph.D., has been appointed lecturer in malting, brewing and applied biochemistry at Birmingham University. DR. J. P. G. FARR, Ph.D., has been appointed Joseph Lucas research fellow in the Department of Industrial Metallurgal, and MR. T. B. VAUGHAN, M.Sc., and MR. G. A. SALTER, B.Sc., have been appointed research fellows in industrial metallurgy at Birmingham.

● President of the Royal Society, SIR CYRIL HINSHELWOOD, has appointed the following vice-presidents for the year ending 30 November 1959: SIR WILLIAM PENNEY, K.B.E., treasurer of the Royal Society, director of the Atomic Weapons Research Establishment, Aldermaston; SIR LINDOR BROWN, C.B.E., biological secretary of the Royal Society, Jodrell professor of physiology at University College, London; PROFESSOR W. V. D. HODGE, physical secretary of the Royal Society, Lowndean professor of astronomy and geometry in the University of Cambridge; and SIR CHARLES DODDS, M.V.O., Courtauld professor of biochemistry in the University of London.

● MR. JOHN BOULTON, of Wilmslow, and head of the research department of Courtaulds Ltd., Campbell Street, Droylsden, has been elected president of the International Federation of Associations of Textile Chemists. He is the first Briton to have been honoured by election to this position. Mr. Boulton succeeds Dr. L. Sessa, of Italy, the retiring president. The new vice-president is Dr. Hens Ris, of Basle, Switzerland.

Mr. Boulton has achieved rare distinction in his career. He is the president of the Society of Dyers and Colourists. Prior to assuming the presidency of the society in the spring of 1958, he was the hon. secretary of the Textile Institute.

● MR. G. W. RILEY, M.I.Chem.E., has retired from the boards of George Scott and Sons (London) Ltd., Leven, Fife, and Ernest Scott and Sons Ltd. He will, however, continue to serve the companies as technical consultant. Mr. Riley retires in his sixtieth year of continuous service with both companies.

● MR. ROGER N. JUKES has been appointed product design manager for Quickfit and Quartz Ltd., manufacturers of interchangeable laboratory glassware, Stone, Staffs. He has been with Q. and Q. for nearly 12 years on the staff of the development director, MR. DONALD CURTIS. The new post is in line with the company's policy of ensuring that its products are 'technically correct'. Mr. Jukes will also be responsible for technical service and the preparation, from the technical aspect, of Q. and Q. literature and instruction leaflets.

● MR. J. P. LEWIS, who has been appointed general manager of the British 'Rema' Manufacturing Co. Ltd., One Industry Road, Sheffield 9, has been associated with the design, manufacture and installation of cement plants and the supply of crushing, grinding and handling equipment, with the parent company, Edgar Allen and Co. Ltd.

● Four members of Geigy (Holdings) Ltd. have received gold watches as long-service awards. Each has had 25 years' service with the Geigy company. They are MISS AGNES SYKES, head of textile chemicals order department, MR. C. MUSGRAVE, head of the plastics colour laboratory, MR. A. W. BURKILL, assistant works manager, and MR. R. YOUNG, inks process.

● DR. ALBERT L. ELDER, director of research of the Corn Products Co., Argo, Ill., U.S., and an authority on medicinal chemicals, proteins, and starches, has been chosen president-elect of the American Chemical Society. President for 1959 will be DR. JOHN C. BAILAR, Jr., professor of inorganic chemistry at the University of Illinois, who took office on 1 January. During the war Dr. Elder directed the construction and co-ordination of 20 plants for the production of penicillin in the U.S. and Canada. He also was closely associated with the early development of the Government's syntheic rubber programme. DR. W. J. SPARKS, new director-at-large of the A.C.S., was co-inventor of butyl rubber and has received more than 100 patents for his pioneering developments in rubber research. From 1957 he was scientific adviser to the Esso Research and Engineering Co., Linden, N.J.

● Following the news in CHEMICAL AGE, 27 December, p. 1063, that DR. A. J. KESTERON would be assuming the managing directorship of Davy British Oxygen Ltd. early in 1959, we learn that he will not now take up this appointment.

● MR. BRIAN POLLARD, of Constructors John Brown Ltd., left by air for New York on 13 January, to establish an office for the sale of Kittel plates in the U.S. Constructors John Brown have held the licence for the design, manufacture and sale of Kittel plates within the U.K. and Commonwealth since 1954. Mr. Pollard joined the company to develop this and to build up a section specialising in counter-current processes. The company recently acquired licensing rights for the U.S. Kittel plates, now used for a wide variety of counter-current processes, combine the advantages of high throughput and low pressure drop, with low cost and ease of maintenance. Initially Mr. Pollard will be staying at the Hotel Commodore, 109 42nd Street, Lexington Avenue, New York City.

B. Pollard

John Acton

● MR. JOHN ACTON, M.Sc., A.R.I.C., has been appointed new products manager of Midland Silicones Ltd., 68 Knightsbridge, London S.W.1. This is a new post and Mr. Acton will be responsible for launching and marketing all new silicone, or silicone-containing, products developed by Midland Silicones. He joined the company in 1955 from Union Carbide Ltd., as a technical representative and latterly has been in charge of sales in S.E. England. He was educated at the Northern Polytechnic, where he took his degree in organic chemistry. This appointment has been made because of the greatly increased sales of the com-

pany and also because of the rapidly increasing diversity of its products. In the last few years, over 2,000 new silicone products have been developed—and of these a considerable number have passed pilot plant stage. Midland Silicones today operate the largest silicone producing plant in Europe, at Barry in South Wales.

● DR. R. L. ELLIOTT, Ph.D., B.Sc., F.R.I.C., head of the department of chemical technology at Bradford Institute of Technology, has been awarded the silver medal of the Society of Dyers and Colourists for his research papers published in the journal of that Society and for his outstanding services to the Society in connection with the inception and running of the Society's associateship and fellowship schemes.

● New appointments in the British branch of the U.S. E. I. du Pont de Nemours Co. are announced. MR. DAVID H. CONKLIN, managing director of the Du Pont Co. (U.K.), has been appointed to the new position of European director of the international department with headquarters in London. MR. WILLIAM H. MCCOY becomes managing director in London in succession to Mr. Conklin. These moves have been made as part of a reorganisation of the international department which includes the formation of a Latin American division with headquarters in London.

● MR. W. L. DAY, O.B.E., A.M.I. Struct.E., has been appointed to the board of W. S. Atkins and Partners, consulting engineers, 158 Victoria Street, Westminster, London S.W.1. Mr. Day, who has been chief project engineer of the company's nuclear engineering group since 1956, will be responsible for projects of a nuclear process engineering or chemical engineering nature. Prior to joining W. S. Atkins, he was an assistant director of the chemical plant design group at U.K. A.E.A. industrial group, Risley.

Major Board Changes for U.K. Geigy Group

MR. E. G. TURNER, who as announced last week has been appointed chairman of Geigy (Holdings) Ltd., Manchester, in succession to MR. C. F. GYSIN, is senior partner of Hartley Turner and Son, chartered accountants, Manchester, a firm that was founded by his father in 1885. He joined the board of Geigy in 1952 and became chairman of Geigy Co. Ltd. in 1956. He serves on a number of other boards.

E. G. Turner, who succeeds C. F. Gysin as chairman of Geigy (Holdings)

Mr. Gysin came to Britain from Switzerland in May 1908 and served as general clerk at the offices in London of A. and M. Zimmermann, agents for Geigy. He was appointed to the main agents of Geigy in London in 1916, Henry Freitag. In 1920 the Geigy Colour Co. was founded with Mr. J. R. Nuttall and Mr. Gysin as managers. In 1940 Mr. Gysin became managing director of the Geigy Co. Ltd. and in 1956 chairman of Geigy (Holdings) Ltd.

MR. H. CLAYTON, who succeeds Mr. Turner as chairman, the Geigy Company Ltd., Manchester, joined Geigy in 1932 as an assistant chemist. He organised the technical and commercial beginnings of Geigy's activities outside the textile industry, starting with pigments for paint, printing inks and later plastics. In 1939 he took charge of Geigy's London office and after the war returned to Manchester as a director, becoming joint managing director and, in 1954, sole managing director of the company. He made a number of visits to Australia, setting up Geigy's house in Sydney; he was an original director of Geigy (Australasia) Pty. Ltd., and still retains his seat on the board. He became chairman of Geigy South Africa (Pty.) Ltd. in 1956 and has been commercial director of James Anderson and Co. (Colours) Ltd. since 1938.

MR. H. L. ADDLESHAW, now chairman, Ashburton Chemical Works Ltd., is a practising solicitor and partner in the firm, founded by his grandfather nearly a century ago, which has acted as legal advisor to Geigy since its incorporation in Britain in 1920. In this long association he followed his father, H. P. Addleshaw, who died in 1943. He has been a director of the Geigy Pharmaceutical Co. Ltd. since its incorporation in 1941, becoming chairman in 1956. He joined the board of the Geigy Company (now Geigy (Holdings) Ltd.) in 1940, becoming deputy chairman in 1956. He is a director of Clayton Aniline Co. Ltd.

MR. A. H. WHITAKER, new chairman of James Anderson and Co. (Colours) Ltd., Paisley, has been engaged in the development and manufacture of dyestuffs, dyestuff intermediates and organic and inorganic pigments since 1918 and pioneered the production in Britain of some organic pigmentary dyes previously made only in Germany. He was chief chemist with James Anderson and Co. when the company was acquired by Geigy in 1938 and re-named James Anderson and Co. (Colours) Ltd.; he was then appointed managing director. A founder member of the Scottish section, Oil and Colour Chemists' Association, he was awarded hon. membership of the association in 1956. He is a member of the council, and past chairman of the British Colour Makers' Association.

C. F. Gysin

H. Clayton

H. L. Addleshaw

A. H. Whitaker

Gasification Contract for British Oxygen

A CONTRACT for a tonnage oxygen plant worth nearly £750,000 has been placed with British Oxygen Linde Ltd. by Humphreys and Glasgow Ltd. who are building Britain's first Lurgi pressure gasification plant for production of town gas at Westfield, Fifeshire, for the Scottish Gas Board. The Westfield project will use oxygen and superheated steam for the complete gasification of low grade coal.

The oxygen plant, which will be entirely of British design and manufacture, is being built by British Oxygen Engineering Ltd. It operates on the Tonnox internal compression system. The plant will be capable of producing 200 tons of oxygen per day and is scheduled to go into production during the latter half of 1960.

Will

MR. GEORGE HUMPHREY PIERSON, late a director, secretary and co-founder of Pierson, Morrell and Co. Ltd., fine chemical manufacturers, Queen's Road, Barnet, Herts, who died on 16 August last, left £11,659, £8,061 net.

Obituary

MR. J. S. FLEURET, sales director of Northey Rotary Compressors Ltd., Parkstone, Poole, has died at the age of 39, after a long illness.

MR. WILLIAM GRACE HOLLOWAY, hon. chairman of the board of W. R. Grace and Co., U.S., has died aged 72. During his half-century career with the company he served for a time as chairman of Grace Brothers and Co. of London. Mr. Holloway became chairman of W. R. Grace and Co. in 1945 and held this position until he retired in 1955.

The death has occurred of MR. EDMUND JESSOP HOYLE, of Collcrest, Huddersfield Road, Brighouse, at the age of 60. Mr. Hoyle was associated for 36 years with L. B. Holliday and Co. Ltd., aniline dyes, Deighton, Huddersfield, and had been a director for 21 years.

CHEMICAL RESISTANCE OF CELLOBOND POLYESTER RESINS

IN general all Cellobond polyester resins have good chemical resistance, British Resin Products, Piccadilly, London W.1, report. Some are recommended particularly, however, for specific applications. Cellobond A250 can be used, it is stated, in all types of process and for chemical plant. For use in tropical climates Cellobond A251 is recommended. Where heat resistance is important, Cellobond A2660 should be used instead of Cellobond A250.

Cellobond A2623 is a general purpose polyester-resin for open lay-up. It is stated not to be inhibited by air and to possess excellent non-crazing properties. For impregnation of copper and copper alloys there is the low viscosity resin, Cellobond A2571. This resin is hot setting and will remain usable, it is claimed, for long periods, even when catalysed. It is not inhibited by contact with copper.

The chemical resisting properties of Cellobond glass fibre reinforced laminates are influenced by the method of preparation. A suitable formulation is stated to be:

Cellobond	polyester resin	100g.
,,	catalyst X7764	2g.
,,	promoter X7761	3g.

Casts have been prepared in a mould to give a plane cast ¼ in. thick. These have been cold-set and post-stoved at 120°C (248°F.). Laminates have been prepared from 'E' glass, and 12-ply desized fabric S2/225/E to DTD.5578, 'Volan' treated was used as the reinforcing base. These laminates have been cold-set using a positive pressure of 5 to 10 lb./in.² and post-stoved at 120°C. (248°F.) for 5 hours.

Good resistance to many inorganic and organic acids, to mild and dilute solutions of caustic alkali, to oils, plasticisers, and to many solvents has been shown by the resins. They are not suitable, however, for use with the more concentrated oxidising acids, strong alkalis and chlorinated solvents, such as chloroform and trichlorethylene.

Vats, tanks and containers of any shape can be made. These are non-corrodible, are strong and light in weight. These resins are suggested also for use as piping. Because of their resistance to chemical gases they have been used in the construction of ducting, extractor fans, cowls and stacks.

Further detailed technical information is available from the manufacturers' Technical Note No. P.202, obtainable from the information department.

Tyne Chemical's Developments in Anodised Aluminium Windings

DEVELOPMENTS in technique by Tyne Chemical Co. Ltd., River Drive, South Shields, Durham, have resulted in commercial production of continuously anodised aluminium foil and strip for electrical windings, particularly in magnets and transformers. The company are currently producing anodised material from 0.002 in. thick aluminium foil up to 0.06 in. strip in widths of a maximum of 12 in. continuously anodised in lengths of 1,000 yards. Breakdown voltage figures reached with the new technique are stated by the company to be the highest yet obtained in the field.

With some anodised material 3 in. wide × 0.0035 in. thick, the anodic coating of 6.4 microns at the centre increasing to between 7.3 and 9.4 microns at the edge resulted in breakdown voltage figures of the order of: centre 375, near the edge (about 1 or 2 mm. from the edge) 400, and directly on the edge 480. It is reported that close examination over a considerable length located no points of short circuit, and there was adequate film thickness with a reserve to withstand maltreatment. Even the sharp edges and corners withstood considerable pressure without failure.

Tyne Chemical's present production range is limited to 0.002 in. to 0.06 in. thick and up to 12 in. wide. These limits depend on mechanical considerations but it is hoped that these will be extended in the future. Aluminium or alloys of the metal are anodised uniformly on both faces, thicker at the edges in finished widths. Foil and strip have a sound edge condition free from the edge weakness of slitting burrs. Snags, such as brittleness of film, abrasion resistance and flexibility, are claimed to have been overcome.

Properties of Rigidex Film

Film made from 'Rigidex Polyethylene' is stated to have a higher softening point than conventional material and a superior tensile strength. It has excellent resistance to grease and oils and its permeability to moisture and most gases is low. The film does not 'block' and can be easily processed on automatic machinery. Extrusion conditions for the production of Rigidex film and the properties of blown and lay flat film are given in Technical Information Sheet No. 6, issued by British Resin Products Ltd., Devonshire House, Piccadilly, W.1.

Cosmetic Chemists' Dinner

Annual dinner-dance of the Society of Cosmetic Chemists will be held at the Cafe Royal, London W.1, on 6 February at 7.30 p.m. Non-members will be welcome and tickets, priced at 38s. 6d. each, excluding wines, can be obtained from Mrs. E. Millman, general secretary, at 2 Lovers Walk, London N.3.

Polyurethane Foam Production Simplified by 'Ready-mix' Pre-polymer

DALTOCEL PP1, a new I.C.I. pre-polymer obtained by reacting a polyether with an organic di-isocyanate, is suitable for use in the manufacture of flexible polyurethane foams. The introduction of this product means that manufacturers will no longer need to handle or mix the separate reactants.

100 parts of Daltocel PP1 should be mixed with 4.6 parts of an activator consisting of a catalyst mixed with an emulsifier and water. Reaction and expansion to produce a high-quality foam of fine pore structure take place within 20 minutes, after which processing is completed by curing for 2-4 hours at 120°C in air.

Daltocel PP1, which is stable for at least three months at 45°C if stored under dry conditions, is a pale yellow viscous liquid, neutral in reaction, but containing some free tolylene di-isocyanate which necessitates appropriate precautions in handling. It is suitable for use for foam production in continuous processing machinery. The recommended catalyst and emulsifier are catalyst SFC and Lubrol SF2, although users may wish to experiment with different activators with a view to varying the physical properties of the foam produced.

Bradford Symposium on Radiation Chemistry

A SYMPOSIUM, designed to present an up-to-date picture on radiation chemistry is to be held at the Bradford Institute of Technology, Great Horton Road, Bradford 1, on Friday and Saturday, 13 and 14 February. At the Friday session, under the chairmanship of Dr. W. Cule Davies, chairman, chemistry advisory committee, Yorkshire Council for Further Education, Dr. E. Collinson (Leeds University) will present a paper on 'Fundamentals of radiation chemistry.'

On Saturday morning, under Dr. E. G. Edwards, principal of the Institute, Dr. J. H. Baxendale (Manchester University) will present a paper on 'Radiation chemistry of aqueous solutions' and Dr. H. Dalton (Wantage Radiation Laboratories) on 'Radiation and polymer chemistry.' In the afternoon, under Mr. D. R. Wood, president, Bradford Chemical Society, Dr. R. Roberts (Wantage Radiation Laboratories) will talk on 'Radiation effects in organic systems.'

The symposium is open to all interested persons. Those proposing to attend should contact Dr. W. Moore at the Institute's Department of Chemical Technology.

Semi-conductor Bibliography

Fifteen years of 'Semiconducting materials and transistors' is the title of a new bibliography of semi-conductors published by the Newmarket Transistor Co. Ltd., Exning Road, Newmarket.

TRADE NOTES

Laporte Price Changes

Laporte Chemicals Ltd., Luton, Beds, announce the following alterations in prices as from 1 January:

Hydrogen peroxide, 27.5% weight, £119 per ton; *hydrogen peroxide*, 35% weight, £143 per ton (carboys extra and returnable); *sodium perborate*, minimum 10% available oxygen, 1 cwt. free kegs, £139 5s. per ton; *sodium percarbonate*, minimum 12½% available oxygen, 1 cwt. free polythene-lined kegs, £170 15s. per ton.

Molybdated Lead Chrome Pigment

Pure scarlet chrome FMS, a new I.C.I. molybdated lead chrome pigment has high opacity, soft texture, insolubility in organic solvents—combined with good resistance to heat and a soluble lead content within the 5% limit imposed by the Home Office in respect of pigments for spraying applications. In general properties and uses the new pigment is very similar to the two earlier pure scarlet chromes (YS and LYS) introduced by the Dyestuffs Division of I.C.I. in the past year; it is, however, bluer in shade than the two earlier products.

Aerosol Filling Machine

The Presfil aerosol filling machine is to be demonstrated at the Packaging Centre, 50 Poland Street, London W.1, by Metropole Industries Ltd., 15-17 Eldon Street, London E.C.2, daily from 26 to 30 January (10 a.m. to 4.30 p.m.).

New Telephone Number

The new Bexley Heath telephone number (Crayford 26262) noted last week for Frederick Braby and Co. Ltd., will not come into use until 11 February.

Booklet on Noralduct

A new booklet on Noralduct, solid aluminium sheet having internal systems of passages and ducts, is available from the Northern Aluminium Co. Ltd., Banbury. The material is particularly suitable for heat transfer equipment and, as the integral passages can follow almost any complex continuous pattern that can be drawn on paper, there are many other possibilities. Sheets of Noralduct can be formed after manufacture in either a plain or an impressed pattern finish. Colour can be included in the product design as there are no welds to spoil the appearance of an anodised finish. The booklet describes actual and potential uses and includes a guide to tolerances and manufacturing limits.

Durham Appointed Schule Agents

Durham Raw Materials Ltd., 1-4 Great Tower Street, London E.C.3, have been appointed sole selling agents in the U.K. for the full range of filter presses manufactured by F. H. Schule A.G., Hamburg 26.

Schule filter presses are of two basic types: flush plate and frame presses for use where filter cake is of uniform thickness and porosity and facilitates an effective flushing of the solids; and recessed plate presses, for use where solids are subject to blockage. There is a lightweight filter press available for application where a maximum pressure of 45 lb. p.s.i. is stipulated and a special laboratory filter press with a 5 in. plate fitted with Plexiglass frames and plates is available to provide for visual control of the filtering and washing processes. Samples of slurry sent to Durham Raw Materials will be forwarded to the Schule Laboratory, where advice will be available as to the most suitable filtration process and equipment.

Itaconic Acid

Kemball, Bishop & Co. Ltd., Crown Chemical Works, Bromley-by-Bow, London E.3, announce a reduction in the price of itaconic acid, pure, with effect from 1 January 1959. This intermediate is now available at 4s. 9d. per lb. for 500 lb. lots. Recent information on new uses for itaconic acid is available on request.

Thermosetting Silver Film

A new thermosetting silvering preparation has been developed by Johnson Matthey and Co. Ltd., 73-83 Hatton Garden, London E.C.1, and has been given the code name FSP 35. This preparation is based on silver in the form of finely divided flake and is specifically designed to enable surface films of relatively high conductivity to be applied by spraying or brushing to such materials as plastics, ceramics, graphite and glass. The only limitation on its application to these surfaces is that the material being coated must withstand heating to 80°C, the minimum temperature necessary for curing the organic vehicle that carries the silver. The preparation has excellent covering power and the stoved film is hard and abrasion-resistant, with an electrical resistance in the range 0.2 to 2 ohms per square. The film will withstand water and is not affected by many of the organic solvents in general use.

T. Tillings' Aerosol Arrangements

Arrangements have been concluded between SAFCA and Commercial Plastics, both members of the Thomas Tilling Group, for joint operations as aerosol fillers and valve producers and Safca Aerosol Manufacturing announces that the company has been renamed Aerosol Packaging Co. This new company will be devoted solely to aerosol filling and packaging.

Development, manufacture and marketing of the Safca Valve will now be handled by a new company, the Safca Aerosol Valve Co. Sales offices of the new companies are at 75 Grosvenor Street, London W.1. Telephone, Grosvenor 8925-6.

Nu-Swift Approved in W. Germany

As the result of technical negotiations and tests extending over four years, six of the principal models of Nu-Swift pressure-charge-operated fire extinguishers have now been approved by the West German Government. This is the first time that British-made extinguishers have been approved for sale and use in the Federal Republic. German requirements are exacting and include not only examination of the design and quality of the extinguishers, but also tests of their fire extinguishing capacities. After these have taken place, the extinguishers are bonded for a period of two years and then re-examined.

Pile-driven Anodes

Metal and Pipeline Endurance Ltd., Artillery Mansions, Victoria Street, London S.W.1, have introduced a pile-driven anode to minimise the installation costs of magnesium anodes for the protection of pipelines in normal low resistivity soils where magnesium anodes are generally installed. The anodes can be driven to a depth of 4-5 ft. in two or three minutes, and it is only necessary to have small excavation to expose the top of the pipe for attachment of the anode wire, instead of a large excavation to bury the anode. The anodes are available in 9 lb. and 17 lb. sizes, and jigs are available for driving the anodes utilising a power Warsop rammer or some similar equipment.

DIARY DATES

MONDAY 19 JANUARY

Phys. Soc.—London: Horticultural Halls, S.W.1. Physical Society exhibition. Until 22 January.
R.I.C.—Leeds: University, 6.30 p.m. 'Radiation hazards of the atomic age', by F. W. Spiers.
R.I.C.—Ponders End: Enfield Technical College, 7 p.m. 'Chemistry of poisoning', by A. S. Curry.
S.C.I.—London: 14 Belgrave Sq., S.W.1, 5.30 p.m. 'Resistance to insecticides', by F. R. Bradbury.

TUESDAY 20 JANUARY

C.S.—Newcastle upon Tyne: King's College, 5.30 p.m. Tilden lecture: 'Triplet state in chemistry', by G. Porter.
I.Chem.E.—Chester: Blossoms Hotel, 7 p.m. 'Separation of isotopes by molecular distillation', by P. T. Nettley.

WEDNESDAY 21 JANUARY

Inst. Fuel—Leeds: Metropole, 2.30 p.m. 'Rocket fuels', by A. D. Baxter.
Inst. Metal Finishing—Birmingham: Exchange & Engineering Centre, 6.30 p.m. 'Applications of plastics-coated steel sheet', by W. E. Martin & F. H. Smith.
R.I.C. with S.C.I.—London: University College, Gower St., 6 p.m. 'Impact of colloid science on technology', by Sir Eric Rideal.
S.C.I.—Dublin: Trinity College, 7.45 p.m. 'Titanium and its alloys as materials of construction in chemical plant', by K. W. J. Bowen.
S.C.I.—London: Brunel College, Acton, W.3, 7 p.m. 'Biological effects of polyoxyethylene esters', by A. C. Frazer.

THURSDAY 22 JANUARY

C.S., with R.I.C. and S.C.I.—Bristol: University, 6.30 p.m. 'Safety in the use and disposal of radioactive materials', by B. A. J. Lister.
C.S. with R.I.C.—Sheffield: University, 4.30 p.m. 'Acetylenic approach to synthesis of natural products', by R. A. Raphael.
C.S. with R.I.C.—Tees-side: William Newton School, Newton, 7.30 p.m. 'Chemical problems in paint coatings', by G. M. Henderson.
Fertiliser Soc.—London: Geological Soc., Burlington House, W.1, 2.30 p.m. 'Biological fixation of nitrogen', by E. R. Roberts.
Inst. Metals—Sheffield: University, 7.30 p.m. Accounts of work in progress in local research laboratories.
Inst. Physics.—London: Inst. Civil Engineers, 2.30 p.m. Symposium on 'Nuclear fuel cycles'. Also on 23 January.

FRIDAY 23 JANUARY

C.S.—Newcastle upon Tyne: King's College, 5.30 p.m. 'Molecular & crystal structure of benzene', by E. G. Cox.
S.C.I.—London: Battersea College, 9.30 a.m. Corrosion group exhibition of apparatus and techniques.

SATURDAY 24 JANUARY

S.A.C.—Cardiff: Queen's Hotel, 2.30 p.m. A.G.M. followed by talk on work of Llandough pneumoconiosis research unit.

Commercial News

- **B.I. Plastics Maintain Final at 12½%**
- **Capital Reconstruction by United Indigo**
- **Norsk Hydro Report Sales Increase**
- **Phenolchemie Double Their Share Capital**

B.I. Plastics

Profits of British Industrial Plastics Ltd. for the first nine months for the year ending 30 September last, were over 20% higher than the previous year but the last quarter of the previous year was exceptionally good and the directors did not anticipate maintenance of a proportionate increase over the whole of 1957-58.

Group profits increased from £906,248 to £979,129, and, after depreciation (£280,515) and tax (£386,106), the net profit is up from £296,073 to £312,508.

The final dividend for the year is being maintained at 12½% on the increased £1,473,813 (£1,248,812) capital. The interim on the old capital was also unchanged at 7½%.

United Indigo

Plans for a capital reconstruction of United Indigo and Chemical Co. Ltd., to include a cash distribution to holders, are to be submitted as soon as possible (probably in February), the new chairman, Mr. G. N. C. Flint, reports. Details have yet to be worked out but holders are advised not to sell pending full proposals. A 'careful examination' is being made of all possibilities of improving the company's profitability (see CHEMICAL AGE, 15 November 1958, p. 814). As previously reported (29 November 1958, p. 913) opposition was organised to a proposed merger with a private company controlled by Mr. S. A. Dohm, a recently appointed director. Mr. Dohm retired from the board shortly before the 15 December annual meeting (see also People in the News).

General Chemical Corp

Application has been made by General Chemical Corporation to the Johannesburg Stock Exchange for the listing of the additional 600,000 ordinary 5s. shares involved in the one-for-one scrip issue. Listing is expected to start on 23 January.

Norsk Hydro

One of Norway's most important nitrogen and chemical producers, Norsk Hydro, report for the year 1957/58 a revenue increase of 7.1% on the previous year and a sales increase of 7.8%, coupled with a production increase in all major fields. Figures were NKr.500.4 million (about £25 million), as against NKr.467.1 million (about £23.3 million) in revenue, and NKr.493 million (about £24.7 million) in direct sales.

Output of finished nitrogen products rose over the year by more than 2,000 tonnes N to 230,600 tonnes N, of which the company's own ammonia production accounted for more than 210,000 tonnes (193,500). In the magnesium field 9,200 tonnes (8,600) of Mg and alloys were produced. A new calcium carbide plant, brought into operation at the start of 1958 is now fully occupied and up to the end of the year had produced 7,400 tonnes, of which 35% was exported and the remainder used by the company itself in p.v.c. production.

Production of Norvinyl p.v.c., given a spurt last summer by the opening of a new 5,000-tonne capacity plant, was 3,700 tonnes (2,400). Soda production stood at 20,000 tonnes (18,500). Overall, sales of nitrogen products, valued at NKr.376 million (£18.8 million), as against NKr.364 million (£18.2 million) is viewed as satisfactory.

Dominion Tar

The Dominion Tar and Chemical Co. (Canada), are raising their dividend from 50 cents to 60 cents per share. The first quarterly payment of 15 cents will be made on 1 May.

Phenolchemie G.m.b.H.

Phenol producers, Phenolchemie G.m.b.H., of Gladbeck, Western Germany, have raised their share capital from DM 3 million (approximately £250,000) to DM 6 million (about £500,000). Owners of the company are, each with 25%, Hibernia A.G., Harpener Bergbau A.G., Rütgerswerke A.G., and the chemical manufacture Scholvenchemie A.G.

NEW COMPANIES

BELGRAVE (MERCURY) LTD. Cap. £100. Mercury merchants, refiners, etc. Directors: S. Taub and S. Solomons. Reg. office: 2 Laurence Pountney Hill, London EC4.

CHEMICAL EXPERTS LTD. Cap. £100. Chemical and pharmaceutical research experts, inventors and developers of and dealers in chemical and pharmaceutical preparations, manufacturers of and dealers in chemicals, gases, drugs, disinfectants, insecticides, germicides, fungicides, weedkillers, and fertilisers etc. Solicitors: Clifford-Turner & Co., 11 Old Jewry, London EC2.

IRISH SYNTHETIC AMMONIA DEVELOPMENT CO. LTD. Cap. £25,000. Manufacturing chemists, etc. Subscribers: S. McCormick, Gosworth, Castle Park Road, Sandycove, Dublin, J. O'Connor.

ISOTOPE SERVICES LTD. Cap. £100. Conduction of research and development in the field of radiology, radiography and electronics generally, and application of radioisotopes. Subscribers: Robert C. Taylor and C. Young. Directors to be appointed. Secretary: W. T. Jansen, 7 Southwark Street, London S.E.1.

LUNDELL (CHEMICALS) LTD. Cap. £100. Manufacturers of and dealers in weedkillers, worm killers, insecticides, soil fumigants, seed dressings, manures and fertilisers, etc. Directors: D. A. Young, R. S. Steven and C. D. Callieu. Reg. office: Bower Lane, Lingsfield, Surrey.

SOUTHERN POLYMERS LTD. Cap. £100. Manufacturers of and dealers in polymers, chemicals, plastics goods, etc. Director: M. Striker. Reg. office: 139 Tottenham Court Road, London W.1.

Market Reports

FRESH BUYING FOR SOME SODA PRODUCTS

LONDON Steady conditions have been reported in the market for industrial chemicals with a good movement on home account, chiefly against contracts. There has also been some fresh buying interest for a number of the soda products and other routine chemicals, and there have been signs of a renewed buying interest in fertiliser materials. Export trade inquiry remains good. Prices have moved within narrow limits and the undertone generally is firm.

Reasonably active conditions prevail in the coal tar products market with pitch in steady request on home and export account.

MANCHESTER Since the last report manufacturers have announced reductions in the prices of hydrogen peroxide and sodium perborate, but otherwise quotations on the Manchester chemical market during the past week have been generally maintained. Industrial consumers are absorbing fair quantities of the leading heavy chemicals against contracts and fresh inquiry on both home and shipping accounts is circulating reasonably well. The demand for fertilisers is rather slow in developing a seasonal expansion but a quietly steady call for most of the tar products is reported.

GLASGOW The Scottish heavy chemical market is returning to more or less normal conditions after the recent holiday period. The past week opened on a quiet note but a marked improvement was noted towards the end, when a much more active position prevailed. Demands were quite varied and covered the usual range of industrial chemicals with quantities involved being fairly well maintained.

Prices have been reasonably firm although some increases have occurred recently.

There has been quite a volume of export inquiries and the market remains satisfactory. In regard to agricultural chemicals the position is still quiet.

NEW PATENTS

By permission of the Controller, HM Stationery Office, the following extracts are reproduced from the 'Official Journal (Patents)', which is available from the Patent Office (Sale Branch), 25 Southampton Buildings, Chancery Lane, London W.C.2, price 3s 6d including postage; annual subscription £8 2s.

Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

AMENDED SPECIFICATION

On Sale 18 February

Dichloracetamides. Parke, Davis & Co. **692 265**

ACCEPTANCES

Open to public inspection 18 February

Manufacture of glass and similar mineral fibres. Owens-Corning Fiberglas Corp. **808 988**

Zone-melting processes and apparatus for carrying out such processes. Siemens & Halske, A.G. [Addition of 775 986.] **809 163**

Pharmaceutical compositions. Imperial Chemical Industries, Ltd. **809 165**

Heat-resistant high tensile silicone rubber gum compositions and method of vulcanising them. Connecticut Hard Rubber Co. **809 166**

Production of sulphur-containing dyestuffs. Badische Anilin- & Soda-Fabrik A.G. **809 224**

Cobalt-chromium base alloy. Deloro Stellite, Ltd. [Addition to 778 359.] **809 088**

Synthetic unicrystalline bodies and methods for making same. Union Carbide Corp. **809 011**

Electrolytic processes. Philco Corp. **809 262**

Organosilicon copolymers and their uses. Midland Silicones, Ltd. **809 263**

Preparation of di-isobutyl ketone isovalerone. Montecatini Soc. Generale per L'Industria Mineraria e Chimica. **809 042**

Method of and installation for regulating the addition of quantities of liquid to a stream of material. Schenck Maschinenfabrik G.m.b.H., C. **809 225**

Dyestuffs of the anthraquinone series. Imperial Chemical Industries, Ltd. **809 043**

Purification of argon. British Oxygen Co., Ltd. **809 168**

Heat treatment of metals in a gaseous fuel-fired furnace. Wellman Smith Owen Engineering Corp., and McLay, G. S. **809 302**

Controlling the consistency of a solid-liquid suspension such as a suspension of wood chips or the like in a liquid. Riegel Paper Corp. **808 994**

Measuring porosity and distribution of pore size. Morgan Crucible Co., Ltd. **808 995**

Steroids and the manufacture thereof. Upjohn Co. **809 046**

Synthesis of steroids. Olin Mathieson Chemical Corp. [Divided out of 809 113.] **809 114**

Stable aqueous suspensions of tetracycline. Pfizer & Co., Inc., C. **809 015**

Auxiliary agents for dyeing and their use. Geigy, A.G., J. R. **809 209**

Production of aminoalkyl ethers of alcohols of the aromatic-aliphatic series. Asta-Werke, A.G. Chemische Fabrik. **809 308**

Radioactive measuring system density compensation. Foxboro Co. **809 018**

Manufacture of polyurethane foam sheets. United States Rubber Co. **809 180**

Copper-containing polyazo dyestuffs. Sandoz, Ltd. [Addition to 695 534.] **809 279**

Method of operating high-vacuum induction furnaces. Deutsche Gold- Und Silber-Scheideanstalt Vorm. Roessler. **809 270**

Process for continuously reacting finely divided solids with liquids and/or gases. Studiengesellschaft Kohle. **809 310**

Processes for influencing the molecular structure of plastics by irradiation, more especially with electrons. Siemens-Schuckertwerke, A.G. **809 183**

Fuel elements for nuclear reactors. Handwerk, J. H., Noland, R. A., and Walker, D. E. **809 280**

Electrodeposition of zinc on magnesium and its alloys. Dow Chemical Co. **809 312**

Production of dosage unit form of hexylresorcinol. American Cyanamid Co. **809 184**

Process of preparing unsaturated aromatic halogen compounds. Polak & Schwarz's Essencefabrieken N.V. **809 186**

Detergent compositions. Hedley & Co., Ltd., T. **809 060**

Preparation of detergent compositions. Hedley & Co., Ltd., T. **809 102**

Organosilicon compounds. Midland Silicones Ltd. **809 313**

Preparation of nitrogen phosphoric acid compounds. Henkel & Cie G.m.b.H. **809 314**

Piperazine compounds. Wellcome Foundation, Ltd. **809 189**

Solubilising amorphous mystatin and compositions containing same. Olin Mathieson Chemical Corp. **809 105**

Chloraprene polymers containing tri-substituted thiourea accelerators. Vanderbilt Co., Inc., R. T. **809 316**

Organo-siloxane compositions. Midland Silicones, Ltd. **809 238**

Manufacturing process for piperazine. Dow Chemical Co. **809 239**

Organochlorosilanes. Midland Silicones, Ltd. **809 317**

Hydration of propylene. Esso Research & Engineering Co. [Addition to 788 883.] **809 318**

4, 4-Difluoro-3-buten-1-yne and salts thereof. Du Pont de Nemours & Co., E. I. **809 319**

Stabilisers for aliphatic, aromatic and heterocyclic compounds containing vinyl groups. Chemische Werks Hüls, A.G. **809 320**

Open to public inspection 25 February

Ceramic material and method of producing same. Plessy Co., Ltd. [Cognate application 3% 641.] **809 439**

Fluid-flow control apparatus. Keelavite Co., Ltd. **809 651**

Recovery of uranium from ores thereof. U.K. Atomic Energy Authority. **809 327**

Vacuum melting of high-melting metals and alloys by means of an electric arc. Heraeus, G.m.b.H., W.C. **809 444**

Process for the manufacture of emulsions of hardenable artificial resins and emulsions so obtained. Ciba Ltd. **809 504**

Growth regulating compounds. Jaeger, K. H., and Mittenzwei, H. **809 505**

Alkyleneimino derivative of hydroquinone and process of making same. Ciba Ltd. **809 535**

Method of and apparatus for the production of carbon black. Phillips Petroleum Co. **809 538**

Continuous production of a metal deposit. Brennan, J. B. **809 540**

Uranium alloys. U.K. Atomic Energy Authority. **809 597**

Apparatus for spectrum analysis. Hilger & Watts, Ltd. **809 364**

Process for the deodorisation of S-(1, 2-dicarbethoxyethyl) o, o-dimethyl-dithiophosphate. Escobar, J. N. **809 653**

3 : 10-Di-(4'-carboxy-butyl)-1:2:6:7-tetrathiacyclodiene and its salts and esters. Merck & Co., Inc. **809 654**

Therapeutic composition for the treatment of hair, scalp and skin. Max Factor & Co. **809 655**

Oxidation of fatty acids. Celanese Corp. of America. **809 451**

Apparatus for separating liquids of different densities. Muller, J. **809 509**

Apparatus for detecting radioactive particle emission. U.K. Atomic Energy Authority. **809 416**

Means for supplying liquid to a liquid transfer roller. Knight, J. P. **809 501**

Emulsification of water-insoluble organic solvents. General Aniline & Film Corp. **809 657**

Polymerisable compositions. Imperial Chemical Industries Ltd. **809 658**

Apparatus for producing molten ammonium salts. Commercial Solvents Corp. **809 336**

Process for rendering substantially pure acetylene safely transportable under super atmospheric pressure. Texaco Development Corp. **809 547**

Fluid-flow control valves. Gonzalez, R. **809 548**

Process and apparatus for complete liquid and vapour phase oxidation of organic material with the production of high enthalpy vapour. Sterling Drug, Inc. **809 604**

Toothpaste containing stannous tin compounds. Hedley & Co., Ltd., T. **809 513**

6-Methyl steroid compounds. British Drug Houses, Ltd. **809 465**

Electron-discharge devices. National Research Development Corp. **809 607**

Injection nozzle. Union Carbide Corporation, formerly Union Carbide & Carbon Corporation. **809 372**

Overtone quartz crystals having low temperature coefficient. Toyo Tsushinki Kabushiki Kaisha. **809 424**

Bodies of chromium boride and chromium molybdenum and their production. Metallwerk Plansee G.m.b.H. **809 555**

Stable solutions of water-soluble amino-aldehyde resins. Monsanto Canada, Ltd. **809 662**

Process of preparing 4.4¹-thiobisresorcinol. General Aniline & Film Corp. **809 338**

Lagging of underground pipes. Stillite Products, Ltd., and Dawson, J. W. **809 609**

Bonding an aluminium or aluminium alloy member to a copper-lead alloy member. Borg-Warner Corp. **809 470**

Process for the reduction of carbonyl compounds. Soc en Commandite Simple Dumont Freres & Cie. **809 339**

Polymers and photographic emulsions containing them. Kodak, Ltd. **809 340**

Process of coating polymeric substrates. Du Pont de Nemours & Co., E. I. **809 558**

Hardener paste for the polymerisation of organic compounds. Deutsche Gold-und Silber-Scheideanstalt vorm. Roessler. **809 559**

Gas-liquid contact apparatus. Pease, Anthony Equipment Co., and Babcock & Wilcox Co. **809 378**

Apparatus for arc melting under reduced pressure. Heraeus G.m.b.H., W. C. **809 561**

Polyethylene compositions. Esso Research & Engineering Co. **809 484**

Blasting initiator. Du Pont de Nemours & Co., E. I. **809 622**

Preparation of wood pulp. Courtaulds, Ltd. **809 429**

Means for de-airing liquid suspensions. Edwards & Jones, Ltd. **809 430**

Dyeing of linear structures of polyacrylonitrile and its copolymers. Badische Anilin- & Soda-Fabrik A.G. **809 382**

Steroids and the manufacture thereof. Upjohn Co. **809 485**

Rotary high vacuum pumps. Heraeus G.m.b.H., W. C. [Divided out of 809 443.] **809 445**

Method and apparatus for producing single-crystal semi-conductor material. Texas Instruments, Inc. **809 486**

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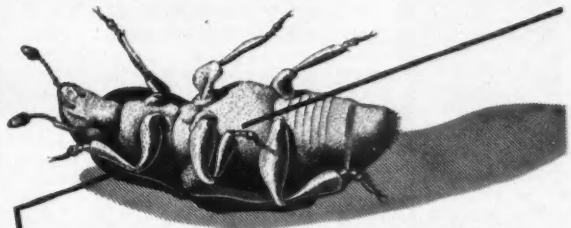

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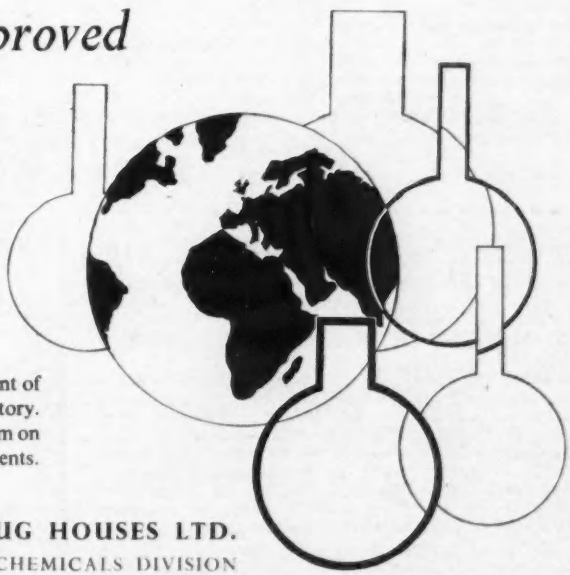

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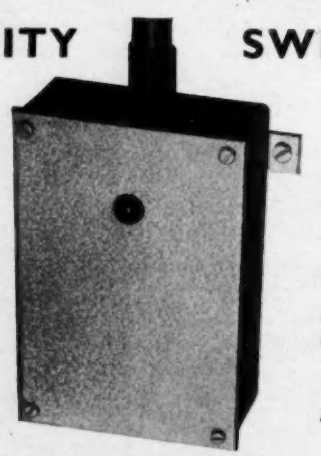

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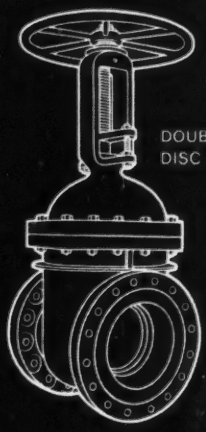

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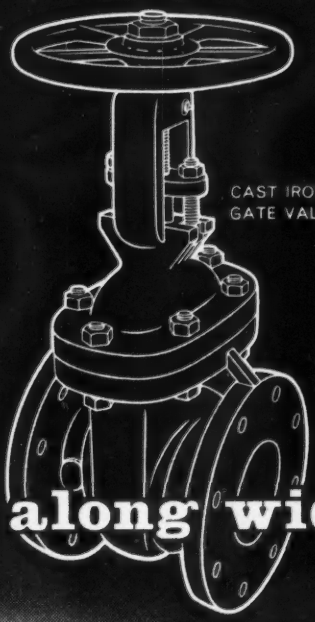

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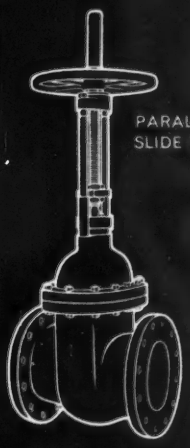

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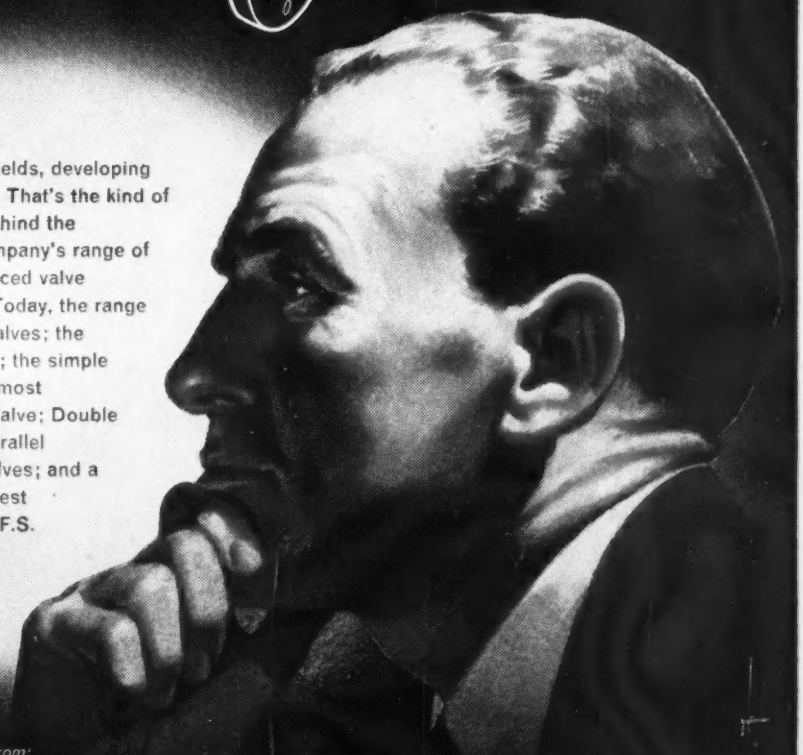

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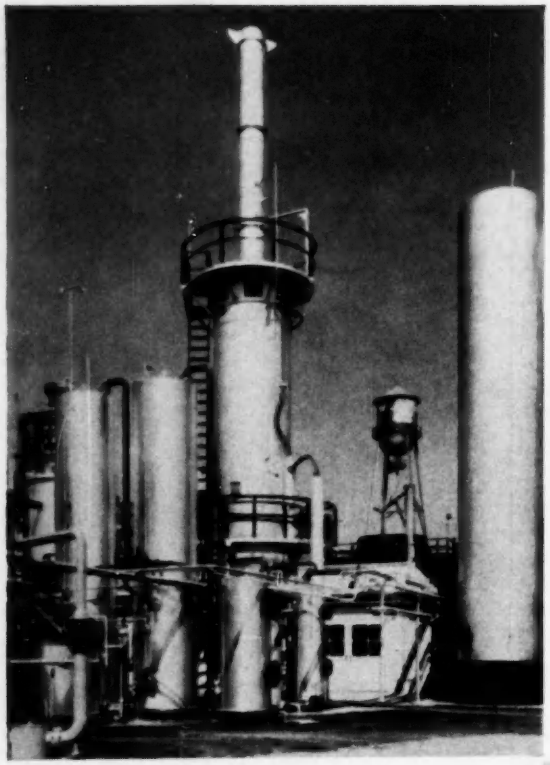

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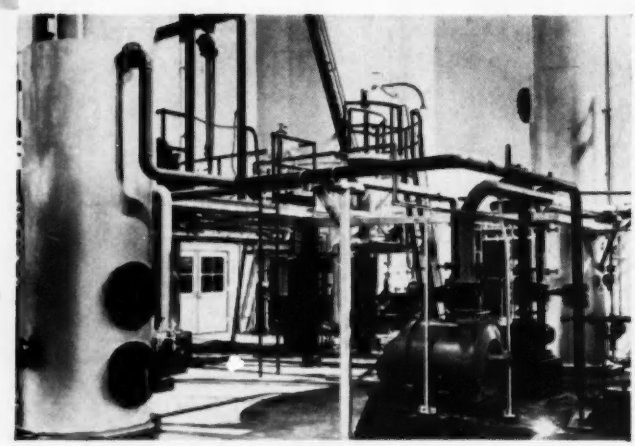

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